MODERN PLASTICS

MAY 1960

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MODERN *

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PLASTICS*

MAY 1960
Volume 37 Number 9

• ENGINEERING

• TECHNICAL

• DEPARTMENTS

Coming Up . . .

Is the next big marketing explosion in plastics going to be expandable polystyrene? Our June lead will outline the rapidly growing market for this material, list the equipment necessary to get into this operation, and present details of capital investments necessary in this business. . . . How the largest vinyl fabric producing plant turns out millions of yards of goods per year. . . . Advances in "foil"-decorating of thermosets and the fabulous markets they presage. . . . What's been happening in plastics for lighting applications. . . . Engineering Section will feature a detailed and mathematical treatment of the problem of reinforced plastics design. . . . Report on a method for improving the optical properties of blown polyethylene film by using a tubular annealing chamber. . . . Technical Section will report on permeability of chlorotrifluorethylene polymers. . . . Characteristics of molybdenum disulfide-filled nylon. . . . Also in the works: what the Italians are doing with polypropylene.

ABC
ABP

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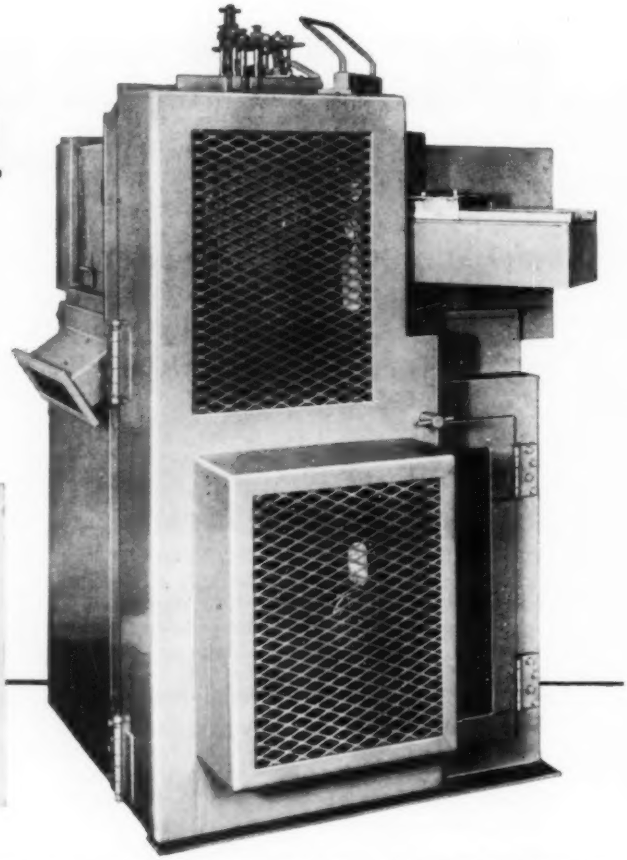
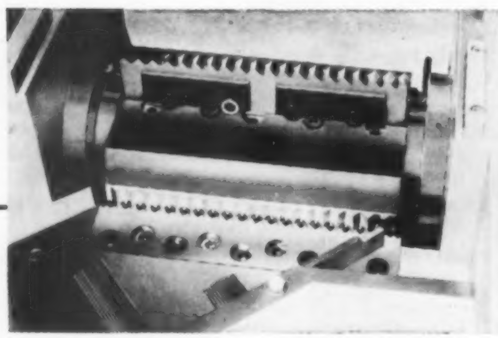
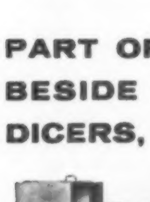
"Stair-Step" DICING MACHINE





PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS



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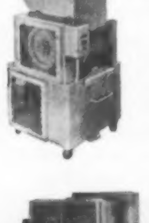

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QUALITY CONSTRUCTION Ruggedly built. All surfaces contacting plastics materials are of corrosion resistant metals, stainless steel or chromium plated.

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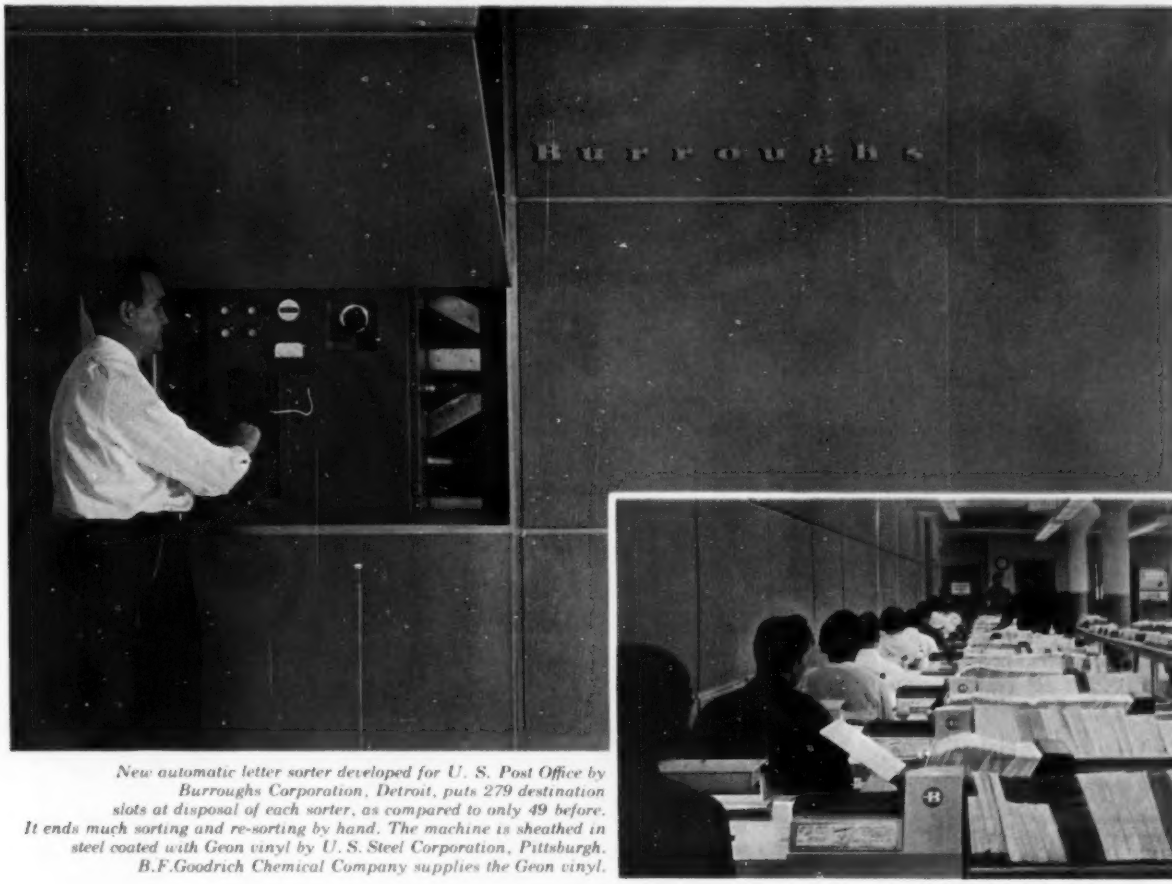

New automatic letter sorter developed for U. S. Post Office by Burroughs Corporation, Detroit, puts 279 destination slots at disposal of each sorter, as compared to only 49 before. It ends much sorting and re-sorting by hand. The machine is sheathed in steel coated with Geon vinyl by U. S. Steel Corporation, Pittsburgh. B.F.Goodrich Chemical Company supplies the Geon vinyl.

U. S. Mail sorting goes automatic

with new machine sheathed in steel coated with Geon vinyl

This new automatic mail sorter converts the age-old "peek and poke" hand method of sorting letters by destination to a smooth, 43,000 letters-per-hour sorting by machine. 78 feet long and 10 feet high, the machine is sheathed with a versatile new combination—steel coated with Geon vinyl.

The Geon coating provides a soft, pleasant look and feel. It can be washed. It won't scuff or stain. The color is permanent and the coating protects the steel against both wear and corrosion.

Geon-coated metals can be formed, bent, even projection-welded without damage to coatings. Products can be made to match the color combination or texture of almost any material.

Geon coatings also offer superior abrasion, electrical and chemical protection for the metal. It's another example of the way that versatile Geon is improving products and opening new markets. For more information, write Dept. GJ-5, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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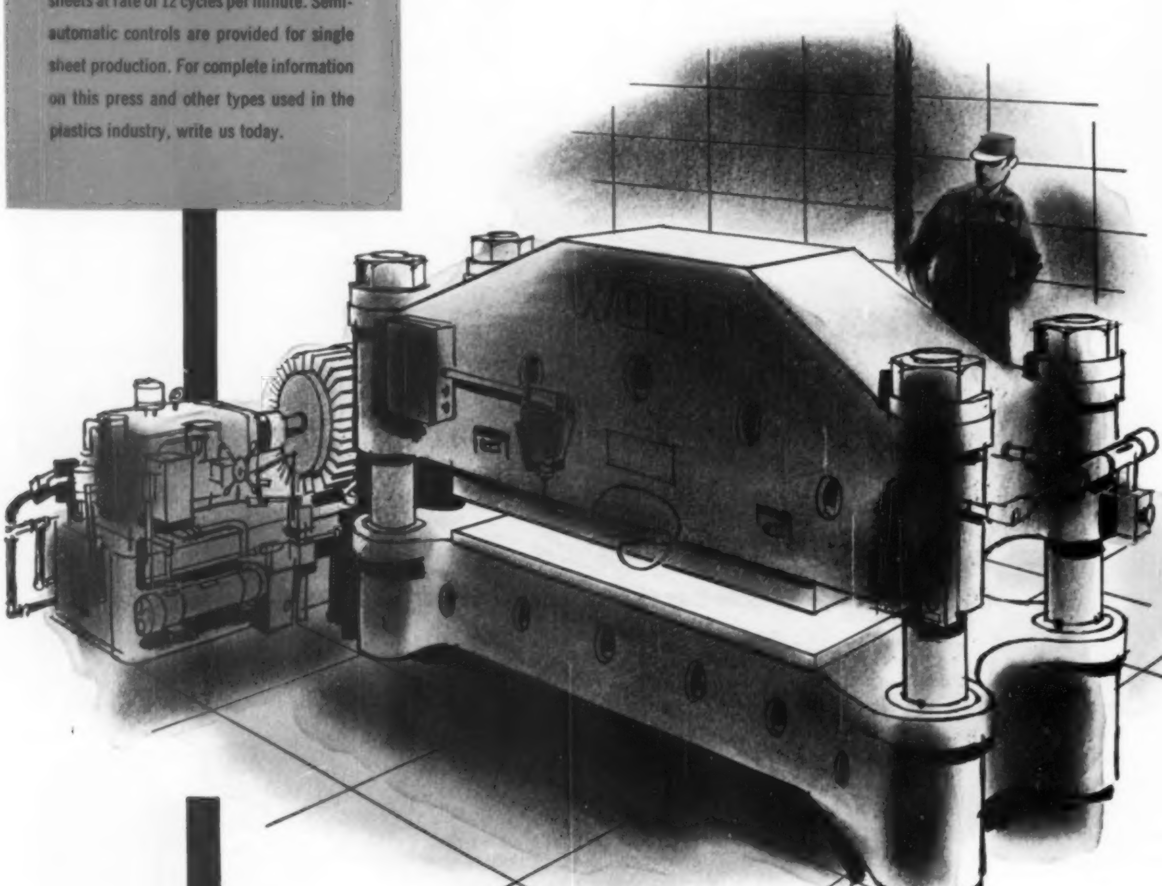

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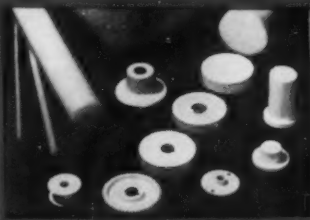
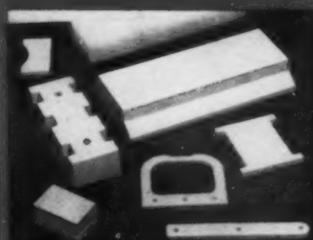


Cadco NYLON ROD: Ideal for applications stressing reduced wear in moving parts. Diameters, 1/16" to 15"—Lengths to 10 feet.



Cadco NYLON SLAB: For applications requiring abrasion resistance, low friction and high shock resistance, mechanical strength. Thicknesses, 1/16" to 2"—Widths to 12"—Lengths to 10 feet.

Cadco NYLON STRIP AND SHEET: May be econimically stamped, blanked deepdrawn, vacuum formed, or welded. Thicknesses, .010 to 1/8"—Widths, 1/4" to 6"—Lengths; Coils up to 24" OD, 15" ID (equals 2300 feet at .010" thickness, 740 feet at 1/8" thickness).

Cadco NYLON TUBING: Recommended as tubing or pipe, and as stock for fabrication. Thin-wall tubing, Nominal OD, 1/16" to 3/8"—Nominal ID, .034" to .225". Length; Coils of 30" outside diameter (equals 1250 feet at 1/16" OD, 100 feet at 3/8" OD). Other tubing in lengths to 10 feet.

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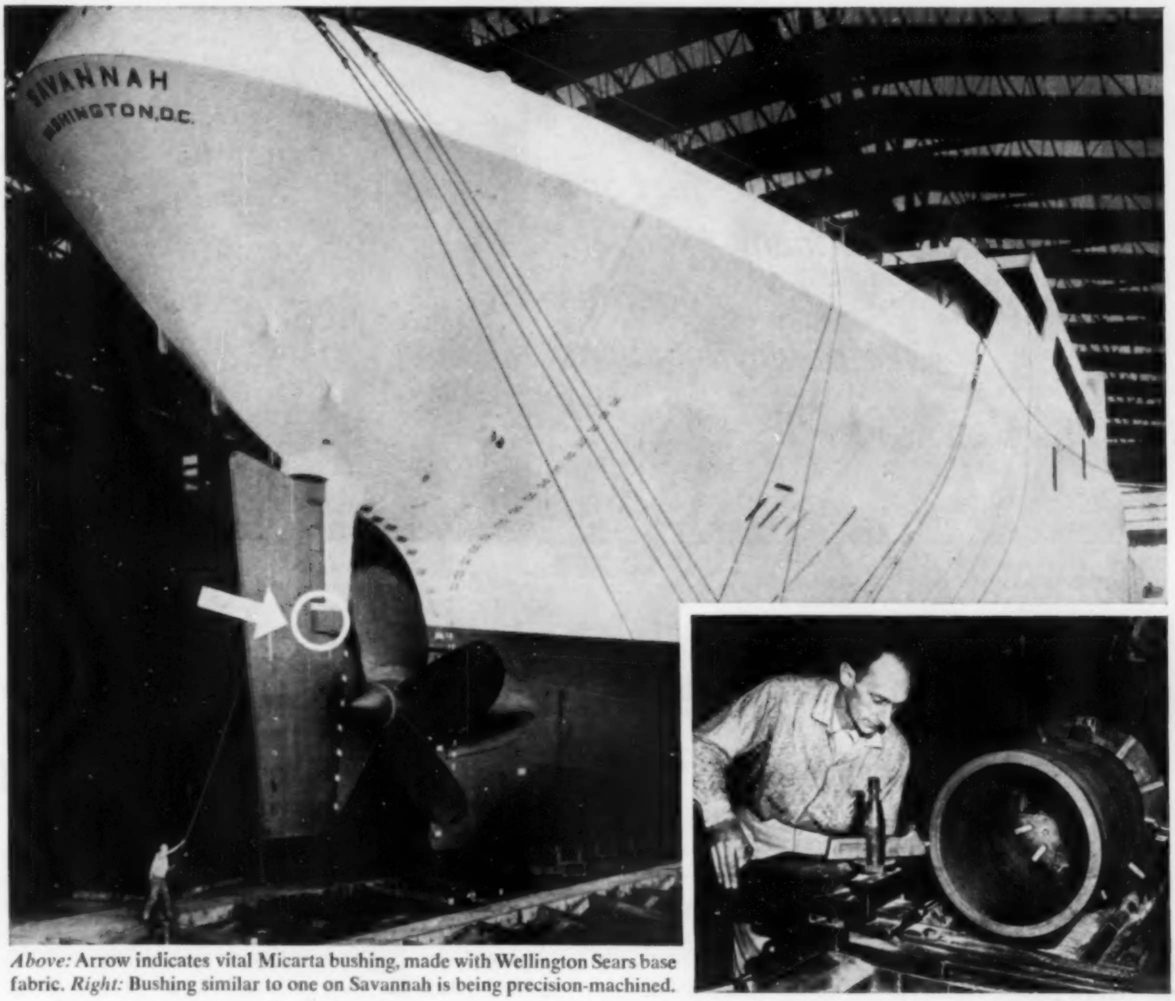
Fabric helps world's first nuclear merchant ship steer true course



Above: Arrow indicates vital Micarta bushing, made with Wellington Sears base fabric. *Right:* Bushing similar to one on Savannah is being precision-machined.

With the N. S. Savannah ready to start setting new transoceanic speed records for merchant ships, a 60-lb. bushing enclosing its rudder pintle assumes great responsibility for keeping the nuclear-powered ship on course.

This type of bushing, while relatively insignificant on ordinary vessels, is of great importance on the Savannah because of the unusual stresses placed on the rudder by the ship's added speed.

The material selected for this vital job is Westinghouse Micarta, using Wellington Sears base fabric. This phenolic laminate was chosen, according to architect George G. Sharp, "for economy, utility, efficiency, and safety of the ship." The bushing was fabricated by Hershell Engineering & Supply Company of Philadelphia, a member of the Micarta Fabricators Association.

Providing base fabrics that solve such complex problems as this is only one of the many ways Wellington Sears meets the changing fabric needs of industry. Why not find out how our 114 years of experience can help solve your problems with fabrics for laminating, coating, rubberizing and other industrial applications. Write today for free illustrated booklet, "Fabrics Plus," Dept. K-5.

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Toughness . . .
just one
of many excellent
properties
of vinyl coatings
made with THF

Here's how producers of profit from the unique advantages

Exceptionally high solvent power and rapid rates of diffusion and evaporation are unique advantages of Du Pont THF that pay off in many profitable benefits for the manufacturer of quality vinyl-coated fabrics. Here's how:

IMPROVED FABRIC QUALITY. The highest molecular weight polyvinyl chloride resins dissolve readily in tetrahydrofuran, and fabric coatings made from such solutions are exceptionally tough, durable and resistant to soiling, staining and abrasion. In addition to making possible a superior coating, THF's solvent power bites quickly into substrates, providing better adhesion between base material and coating thus reducing the tendency to peel.

INCREASED PRODUCTION. Faster coating-machine speeds—increasing productivity and lowering labor and other unit operating costs—can result from THF's rapid diffusion and evaporation rates. (See photo at right.) In many cases it's possible to coat up to twice as much material in the same length of time, with fabric surfaces coming off the machine dry and tack-free. Also, the high-solids resin solutions feasible with THF make possible fewer coatings to obtain the desired film build-up.

EASY TO PREPARE, APPLY AND STORE. The low viscosity of high molecular weight PVC resin solutions using THF makes them easy to prepare and apply. THF improves the stability of high molecular weight resin solutions, too, thus permitting longer storage periods and less waste of costly resin.

EASY AND ECONOMICAL TO RECOVER. Most existing solvent-recovery facilities can be converted or adapted readily to THF recovery at low cost. Du Pont has helped convert several commercial recovery systems.

Du Pont will be glad to offer its experience to help you in developing your own application for this remarkable new solvent. For more information, contact the nearest address below.

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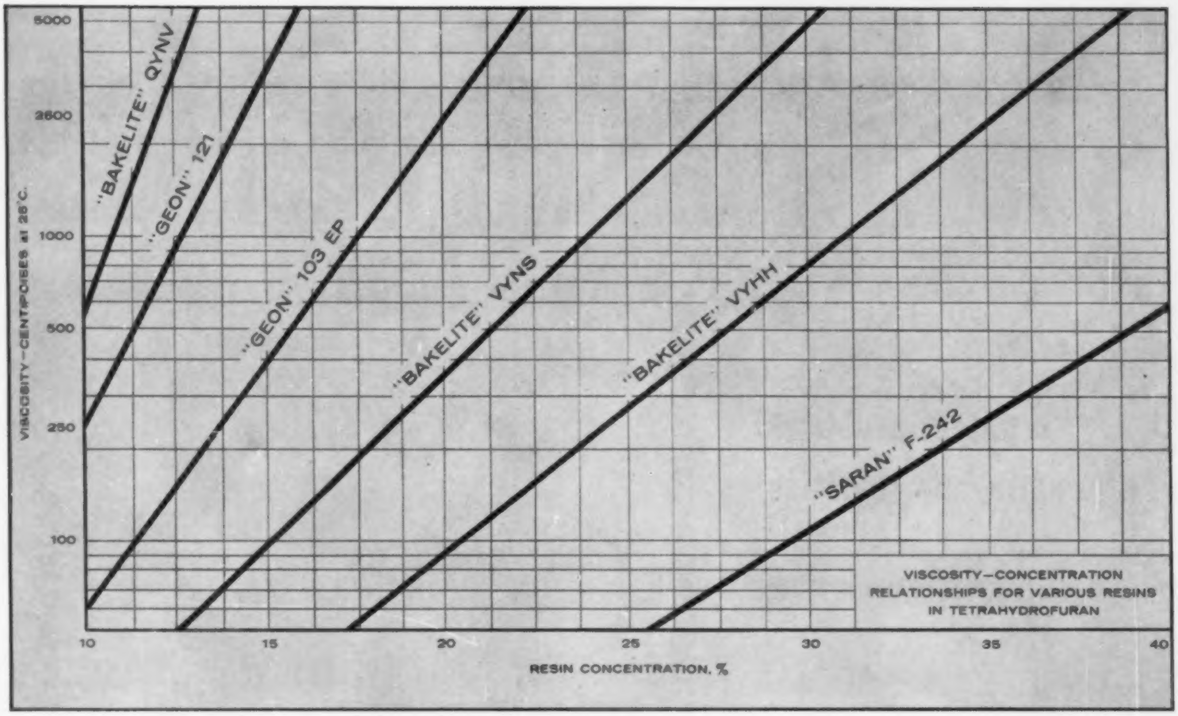
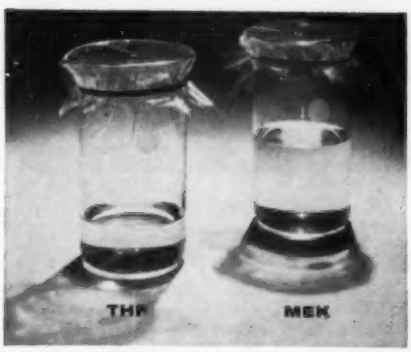


Exceptionally high solvent power of THF is shown in chart above. Note high percentages of various polyvinyl chloride resins which can be dissolved in tetrahydrofuran at room temperature.

"Bakelite"—T.M. of Union Carbide Corp.
"Geon"—T.M. of B. F. Goodrich Chem. Co.

vinyl-coated fabrics can of Du Pont Tetrahydrofuran (THF)



The rapid diffusion rate of THF is shown in test above. Beakers were filled with equal quantities of THF and methyl ethyl ketone (MEK). Both were covered with PVC films and set aside for the same length of time. Result: THF diffused through and evaporated from PVC film about twice as fast as MEK.

THF PROPERTIES

Appearance	Colorless, mobile liquid
Odor	Etherlike
Molecular weight	72.10
Freezing point	-108.52°C.
Boiling range	65°-67°C.
Specific gravity (20°/4°C.)	0.888
Weight, lb./gal. (20°C.)	7.4
Flash point (Tag closed cup)	6°F.

Vapor pressure, mm Hg. at:

15°C.	114	45°C.	385
25°C.	176	55°C.	550
35°C.	263	65°C.	760

Surface tension, dynes/cm. (25°C.) 26.4
Solubility. Miscible with water, soluble in most organic solvents

Du Pont THF is available in all quantities from 55-gallon drums to tank cars.

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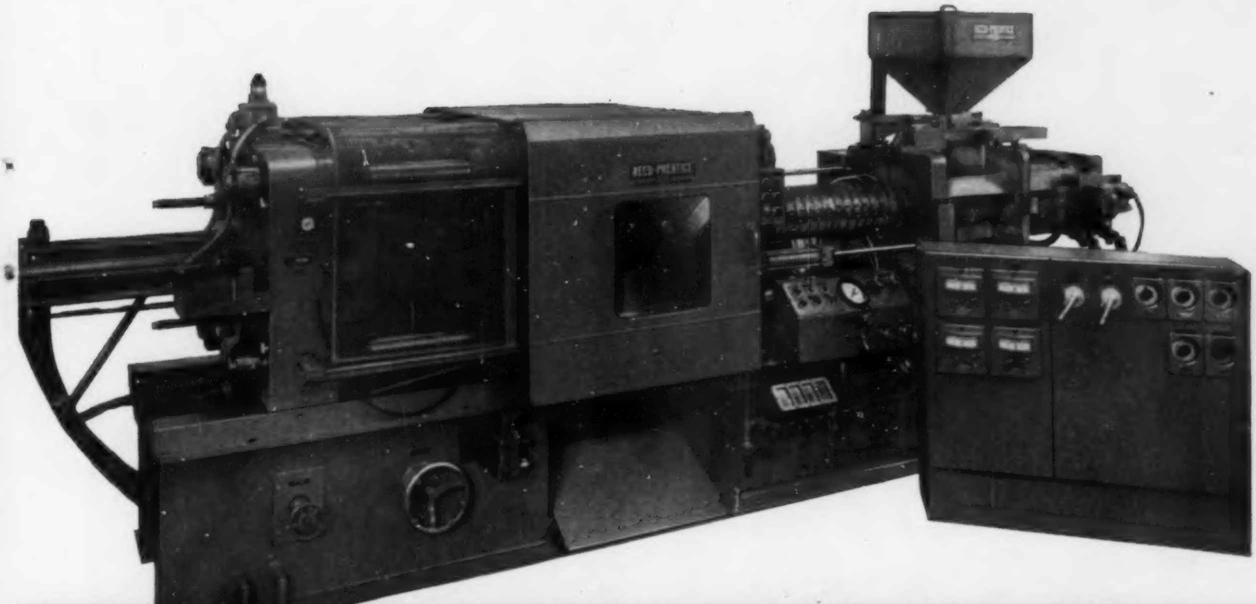

Here are the facts on the new 12/16 oz. REED series, designed for greater molding profits through increased molding flexibility.

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Push-button control on die plate located close to operator for quick accessibility.

Hydraulic mold setup and space adjustments avoid possible nozzle breakage in setting up molds.

Separate electrical panel with pyrometers and timers avoid machine vibration.

Plug-in type heater bands are used for accurate control of front, center and rear zones of heater.

Large, oversized cooler gives added advantage of running machine with 85° water.

One main electrical connection, completely wired—only one power source needed.

Plus: *oil immersed solenoids throughout • swing-out hopper • new indicator-type pump strainers • sight glass water feed control for molds • plug-in timers.*

	350TC	350TCL
Size of die plates	32½" x 32½"	32½" x 32½"
Mold clamping pressure (SPI strain gauge tested)	356 tons	372 tons
Diameter of tie bars	4"	4"
Space between tie bars	20½" x 20½"	20½" x 20¼"
Maximum daylight opening	36½"	44¾"
Mold clamping stroke (adjustable)	7½" to 14½"	8½" to 20¼"
Dry cycle time (Full stroke—clamp & plunger)	6¾ sec. (535 per hour)	7¾ sec. (465 per hour)

NOTE: 450 ton clamping mechanism available with 40" x 40" die plates, 26" x 26" between tie bars and mold clamping stroke from 6" to 22⅝".

See your REED Sales Engineer today for the complete facts about the new REED 350TC and 350TCL, 12/16 oz. machines.

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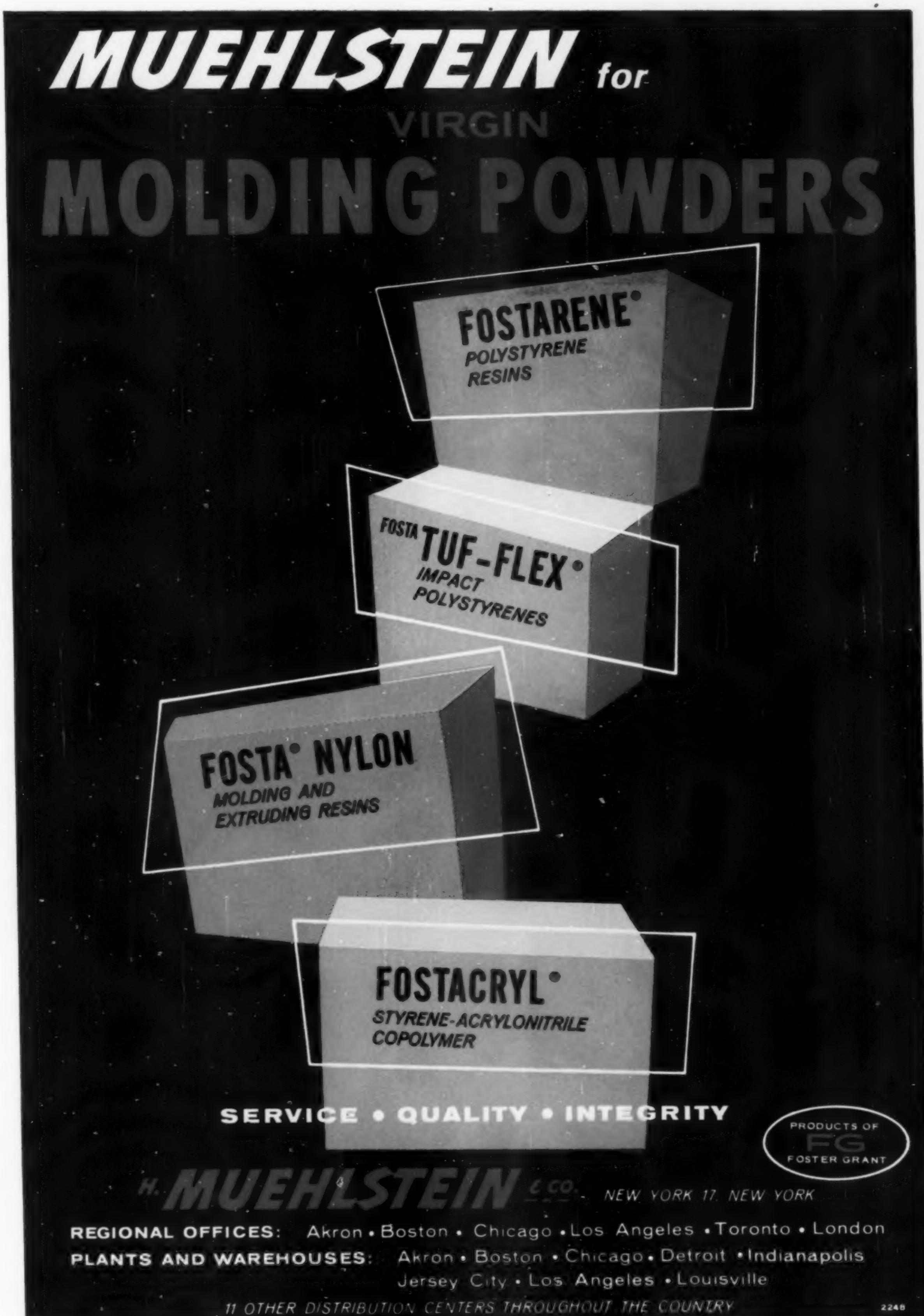
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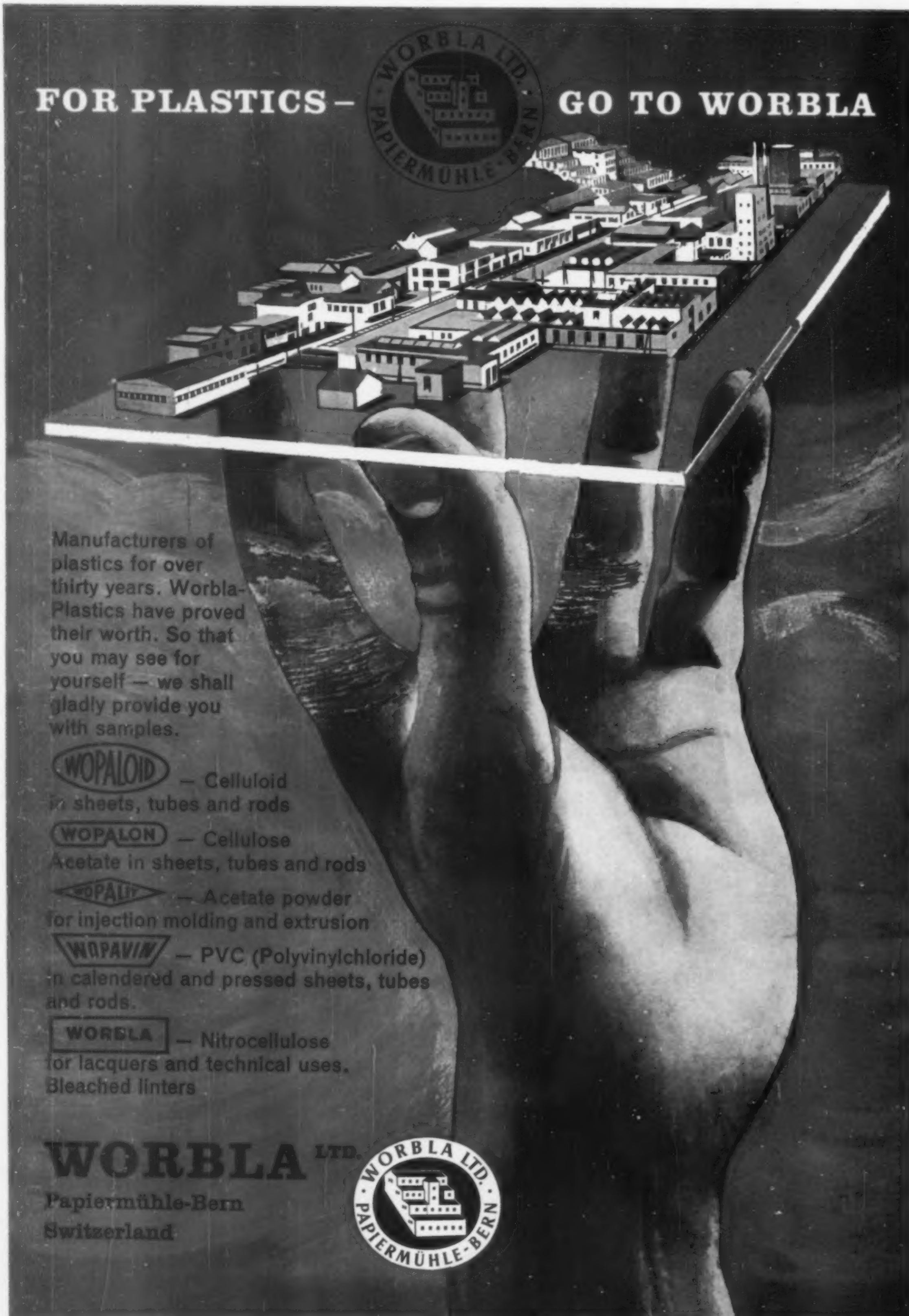
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The Wheelco Series 400 Indicator permits you to read pressure directly on the scale designed specifically for plastics applications. This unit has two standard ranges — 0 to 5,000 PSI and 0 to 10,000 PSI. The Series 400 can also sound an alarm as predetermined limits are reached.

You can record any combination of temperature and pressure up to 24 points with the Wheelco Series 8,000 multipoint printing recorder. This unit has two indicating scales — one temperature and one pressure. The measuring circuit is an automatically balanced, potentiometer type for fast accurate operation.

The Dynisco pressure transducer is specifically designed for use in thermoplastic processes. These units fit standard thermocouple openings and offer fast response to measure pressure fluctuations during the extrusion process.

Ask your Wheelco representative about Wheelco indicator and recording systems for your extruders.

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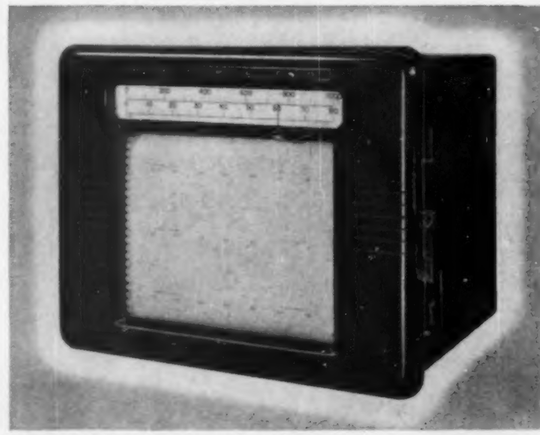
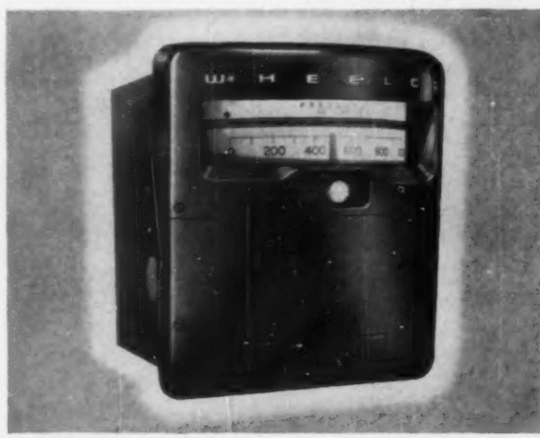
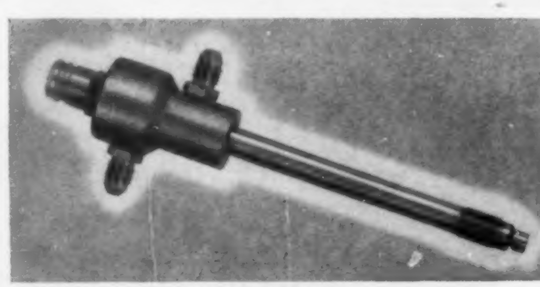
- ✔ Direct reading pressure and alarm signal in one unit
- ✔ Wheelco precision manufacture and dependable instrument quality
- ✔ Wheelco nationwide network of sales and service representatives
- ✔ Recorder charts dual printed. Temperature section 0-800° F. Pressure 0-1000 PSI. Multipliers are used on chart pressure section.



Wheelco Series 8000 Multipoint Recorders



Wheelco Series 400 Pressure Indicator



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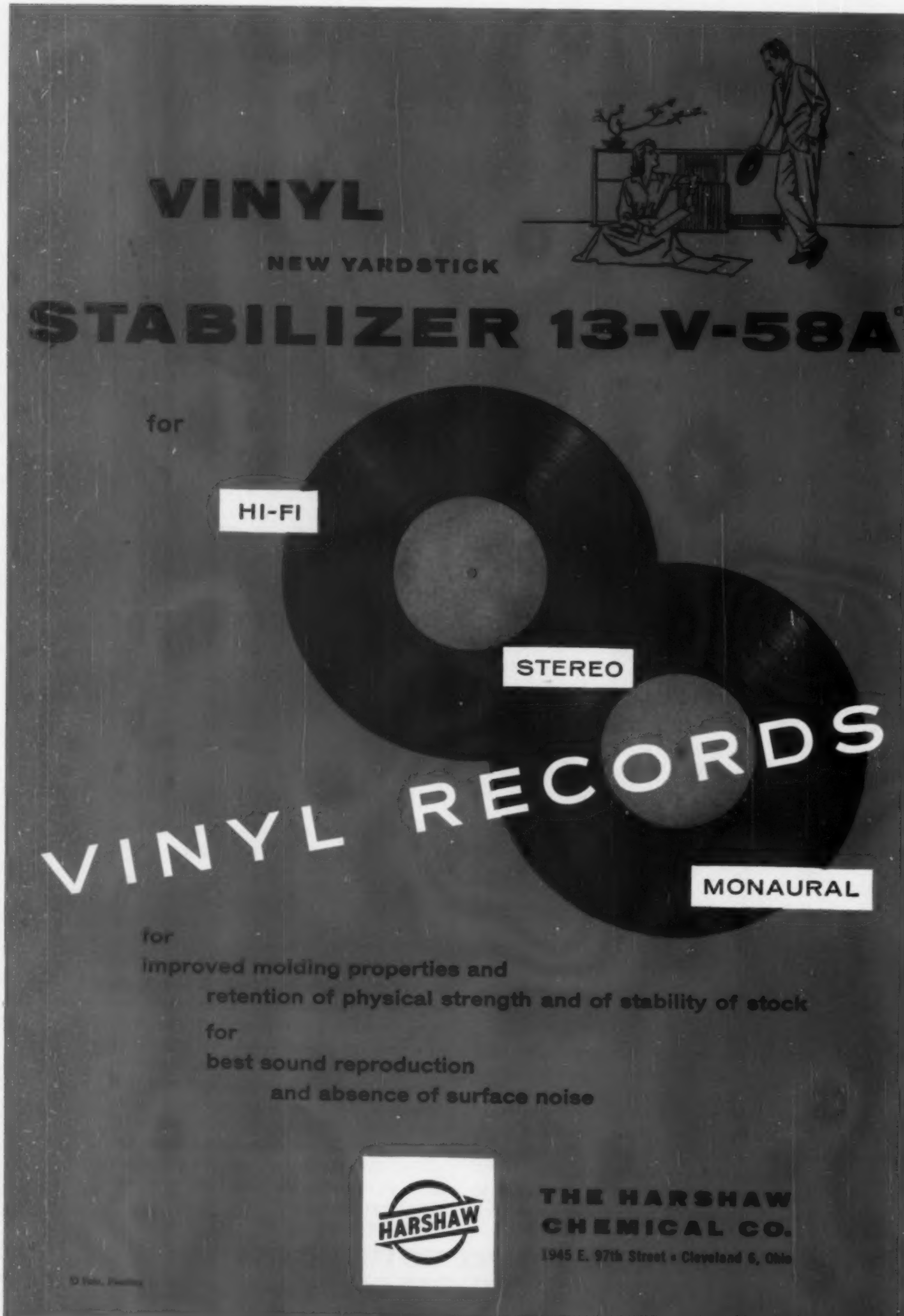

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for
improved molding properties and
retention of physical strength and of stability of stock
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The Spencer Chemical Company has installed a 3½", 24:1 L/D custom-built, extra-long extruder at their sales service laboratory in Kansas City for laminating polyethylene to paper. Versatility figured importantly in their choice of this Sterling unit. Extruder is mounted on a rotary table, allowing use in different positions for lamination, cast-film, blown-tubing and blow-molding.

The Sterling Extruder is a unit of superior performance and service, a product of long experience in the plastics industry. Sterlings are available in sizes 1½" through 6", with L/D ratios of 21:1, 24:1, or 30:1. Sterling offers a full-range of variegated units and installations for both standardized and specialized requirements. For full details, write to—

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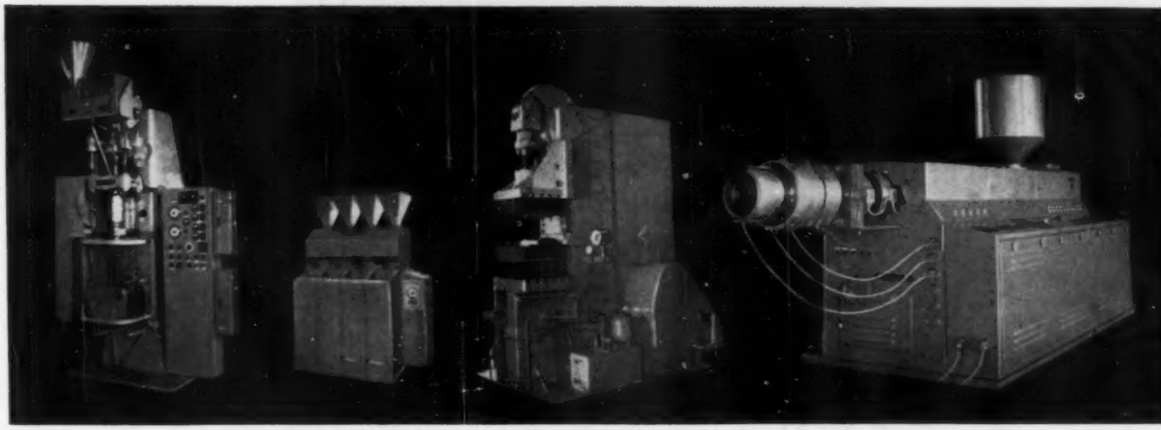

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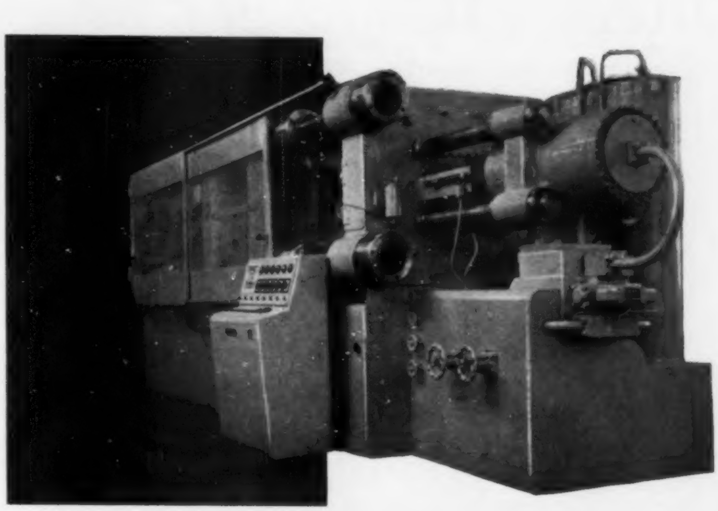

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CANADA: **HUSKY Mfg. & Tool Works (Ontario) Ltd., 200 Bentworth Avenue, TORONTO 13, Ontario**
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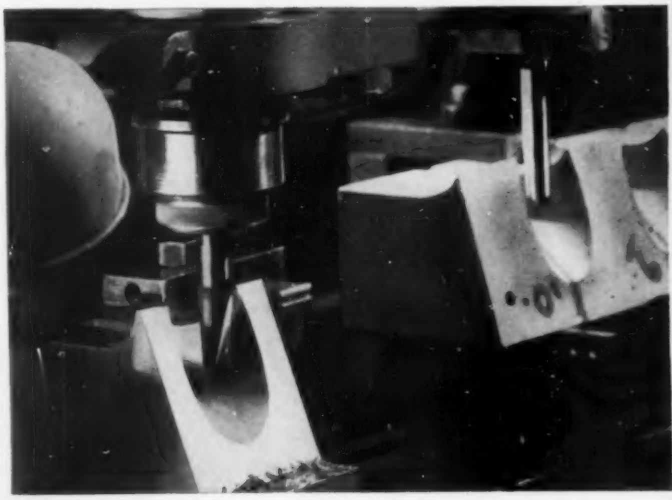

1. *High Polish.* It takes a beautiful polish, one that imparts a silky, smooth sheen to plastic products.

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3. *High Degree of Cleanliness.* Lustre-Die is carefully processed to assure a high degree of cleanliness to minimize porosity or surface pitting.

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for Faster... More Efficient RESIN BLENDING

This new *low-cost* Dake Resin Mixer provides a perfect, uniform mix at all times. The specially designed disc blade shears in, mixing resin solids rapidly with a bottom-to-top blending action which minimizes heat buildup and lessens *kick-over* hazards. In addition, the mixer is completely self-contained and self-supporting, and the counterbalanced motor can be cranked up or down for loading.

Dake Resin Mixers are available in three horsepower ratings and three disc diameters to meet almost every requirement. Write for Bulletin No. 425 for complete specifications.

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Also Manufacturers of a Complete Line of Plastic Molding Presses

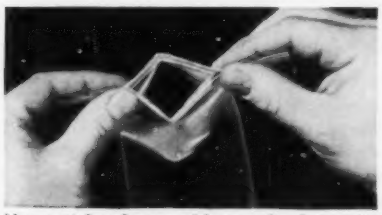
U.S.I. POLYETHYLENE NEWS

A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MAY, 1960 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

A low-cost sterile polyethylene bag with a wire closure is now being used by the dairy industry for milk sampling and is reportedly finding application in a number of markets including frozen foods and cosmetics. In dairy use, the bags are said to reduce sampling costs up to 50% through replacement of bulky glass containers and elimination of washing, sterilizing and breakage.



New container is opened by pressing in on wire tape. A liquid-tight seal is formed by pulling tape taut, rolling top of bag and folding wire ends together.

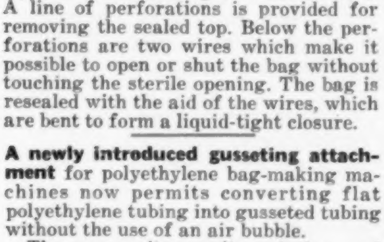
The containers are made of clear, heavy polyethylene tubing, sealed at both top and bottom to keep the inside sterile. A line of perforations is provided for removing the sealed top. Below the perforations are two wires which make it possible to open or shut the bag without touching the sterile opening. The bag is resealed with the aid of the wires, which are bent to form a liquid-tight closure.

A newly introduced gusseting attachment for polyethylene bag-making machines now permits converting flat polyethylene tubing into gusseted tubing without the use of an air bubble.

The new unit permits printing and perforating of flat tubing before gusseting. Among the advantages claimed for this method of converting are improved printing quality, the possibility of printing on one half of the gussets of seamless bags, and placement of perforations within the gussets—without impairing the printed face of bags.

It is also reported that the unit eliminates telescoping rolls and overcomes any tendency of the film to block. Fewer roll changes are necessary, too, because flat tubing gives more footage than gusseted tubing on the same diameter roll. Attendant problems of winding up gusseted rolls are avoided.

The manufacturer reportedly offers complete gusseter kits for any model of polyethylene bag-making machine.



Gusseter attachment for bag-making machines permits converting flat polyethylene tubing into gusseted tubing without the use of an air bubble.

New U.S.I. Resin Produces Film With High Strength, Superior Appearance

Tailored for Produce Bags, New General Purpose Resin to Find Other Uses Where Combined Gloss, Clarity, and Strength Are Needed

The U.S.I. Polymer Service Laboratory has developed a new film-grade resin for producing polyethylene film with maximum clarity and gloss in combination with high impact strength. While the new resin—designated PETROTHENE 112—is tailored for the produce bag market, it should also find application in many other markets where combined gloss, clarity, and strength are desirable film properties.

Melt Index, gms/10 min.	3.0
Density, gms/cu. cm.	.921
Transmittance, %	65
Gloss, %	12
Haze, %	5
Dart Drop gm./F50	210
Draw Down, ft/min	330

Except for drawdown, properties of PETROTHENE 112 were determined on 1.5-mil blown tubing extruded at 330° F. stock temperature on 1½" MPM with 20/1 L/D ratio.

Special synthesis conditions during manufacture give the new resin outstanding flow properties which permit rapid extrusion of film. High drawdown rate of the resin makes it possible to extrude PETROTHENE 112 into thin gauge film without hot snap-offs. In preliminary tests, heat sealability of films made of the new resin was shown to be good under a wide variety of heat and pressure conditions. Treatment of the film for printability has also been accomplished with good results at commercial haul-off rates.

Recommended Extrusion Conditions

For peak gloss and clarity, PETROTHENE 112 should be extruded at about 330° F. stock temperature with a minimum blow ratio greater than 2 to 1.

PETROTHENE 112 is available in low-, medium- and high-slip formulations and in the no-slip form. A technical data sheet on this new resin may be obtained by writing to the Technical Literature Dept., U.S. Industrial Chemicals Co., or any of U.S.I.'s sales offices.

National Distillers' Annual Report is Polyethylene Coated

Cover stock for National Distillers and Chemical Corporation's recently issued 1959 Annual Report is extrusion coated with a protective layer of polyethylene. Advantages of using the polyethylene coating include durability, high gloss finish, and protection of the cover against tearing and soiling. The polyethylene coating also adds to the attractive appearance of the report.

National Distillers' 1959 Annual Report is the Company's third annual report to have a polyethylene coated cover. Pellets of PETROTHENE 203-2 polyethylene resin, the coating resin used, are also shown.

In producing the cover, ten-point cover stock was first gravure printed. The printed roll was then extrusion-coated with PETROTHENE 203-2 resin.

The sheeted covers were next printed on the reverse side by letterpress with rubber plates, then the cover was embossed and stamped with gold leaf.

National Distillers and Chemical Corporation has successfully used tough, clear polyethylene coatings for its annual report for the last three years. The company foresees a growing use of polyethylene coating for publication covers, both for the feeling of quality they impart as well as for their durability.

High Greaseproofness Feature of New Coating Resin

U.S.I. has introduced a new polyethylene coating resin which reaches 100% passage of Military Specification MIL-B-121B for greaseproofness at a lower coating weight than other resins of similar melt index and density. The new resin—PETROTHENE 205-15 with a density of 0.924 and a melt index of 3.0—has excellent adhesion with a wide variety of porous and non-porous substrates.

The flow characteristics of PETROTHENE 205-15 are well suited for high-speed extrusion coating. Coatings as thin as 0.5-mil can easily be applied. Neck-in, which results in costly trim loss, is reduced to a minimum. Polymer build-up at the die is virtually eliminated. According to U.S.I. Polymer Service Laboratories, maximum polyethylene to substrate bond strength is achieved at melt temperatures of 575° F. and higher.

PETROTHENE 205-15 is unique in that it offers the wide heat-sealing range normally associated with a low-density resin, combined with high greaseproofness usually associated with higher density resins. A technical data sheet on this new coating resin may be obtained by writing to the Technical Literature Dept., U. S. Industrial Chemicals Co.

Series V, No. 3

POLYETHYLENE PROCESSING TIPS

FACTORS AFFECTING ADHESION IN EXTRUSION COATING

In the polyethylene extrusion coating process, the nature of the bond between coating and substrate can be chemical, physical or a combination of both. Chemical bonding is involved almost exclusively when the substrate is a non-porous material such as foil or cellophane. With porous substrates such as paper or board stock, physical as well as chemical bonding takes place.

Physical bonding results from the absorption of the molten polymer by the substrate pores. The degree of adhesion is primarily a function of the polyethylene melt index and the surface characteristics of the substrate.

Resins of lower viscosity, which flow more freely, bond more firmly than do higher viscosity resins. The more porous the substrate, too, the better the physical bond will be.

Oxidation Improves Chemical Bonding

Chemical bonding depends on the number of carbonyl (CO) groups on the coating surface at the moment of contact with the substrate. Since carbonyl groups are formed by oxidation of the polymer, conditions which promote oxidation generally result in improved adhesion.

Heat has the greatest effect on oxidation; hence, stock temperature control is important. Figure 1 shows that increasing stock temperature produces an increase in carbonyl groups on the polymer surface. Figure 2, the curve showing the effect of stock temperature on adhesion, is almost identical.

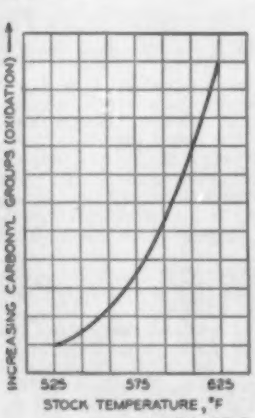


FIGURE 1

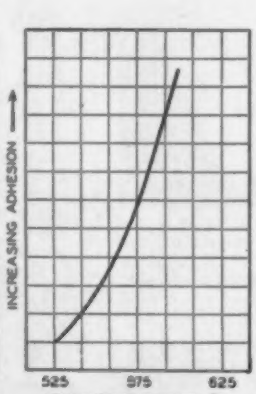


FIGURE 2

A minimum stock temperature of 575°F. is necessary for adequate adhesion in most operations. This value is based on extensive research in the Polymer Service Laboratories of U.S.I. As a rule, temperatures above this are recommended.

The operator, however, must not work at temperatures high enough to cause excessive oxidation. If he does, the polymer will be degraded badly and its heat sealability impaired. Using the above minimum value as a guide, he must determine for each application a stock temperature that will give maximum adhesion without serious degradation.

Controlling Coating Temperature

Several other operating variables affect oxidation of the polymer. Increasing the coating speed allows less time for oxidation to occur, and therefore decreases adhesion. Conversely, heavier coating weights improve adhesion by slowing the cooling time of the molten web. Preheating the substrate has the same effect.

Adjusting Coating Equipment

One measure of coating quality is uniformity of adhesion across the entire width of the substrate. This can be achieved only by careful alignment of the extrusion coating equipment. Chill and nip rolls must be parallel in the same horizontal plane, and the die must be in a plane parallel to the nip.

Pressure applied by the rubber pressure roll should be uniform across its width. And excessive pressure should be avoided since it contributes little to bond strength.

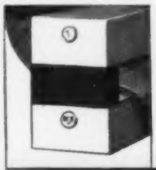
Picking the Right Resin

Good adhesion also depends on the choice of the right resins. Many resins that are excellent for film extrusion, for example, are not quite so good for extrusion coating. U.S.I. has developed the following series of "Petrothene"® resins specifically for the coating process. These resins have excellent coating characteristics and their oxidation is easy to control.

PETROTHENE® Resin	Melt Index	Density	Recommended Coating Weight (Lbs. per 3000 sq. ft.)
200-2	3.0	0.915	20 and higher
201-2	5.0	0.915	10 to 25
203-2	8.0	0.915	3 to 15

U.S.I. Technical Service Engineers are ready to help you select the best resin and operating conditions for your application. Just give us a call.

U.S. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



...GATEWAY TO SAFETY FROM TRAMP METAL

This "handful of trouble" is reason enough for installing an RCA Metal Detector!

A single piece of tramp metal "in hand" is worth thousands of dollars in production time! Any of these small pieces could cause a major plant shutdown if they scored the polished surfaces of the calender rolls. That's why more and more plastics manufacturers and reprocessors are adopting the RCA Electronic Metal Detector as standard equipment on conveyors for exploring raw materials and "pigs."

The RCA Metal Detector may be used on material traveling at speeds from 15 to 1000 feet per minute. It can be arranged to sound an alarm and/or stop the traveling material, detecting the presence of tramp metal, whether magnetic or non-magnetic, before it has a chance to do any damage to machinery.

Reduced downtime, production savings and longer life of calenders and other costly machinery all add up to a profitable smooth-running plant. We believe you will agree that RCA Metal Detectors also can be "worth thousands" in production time, once they start protecting your plant from tramp metal.

Free literature on the RCA Electronic Metal Detector for plastics will be sent to you without obligation. Write to RCA, Dept. G-75, Building 15-1, Camden, N.J.

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RADIO CORPORATION of AMERICA

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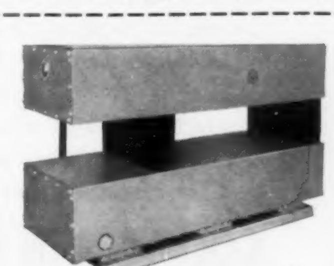

RCA ELECTRONIC METAL DETECTOR

POLYSTYRENE

OR

POLYSTYRENE SCRAP

PLUS

COSTYRENEBLAK®

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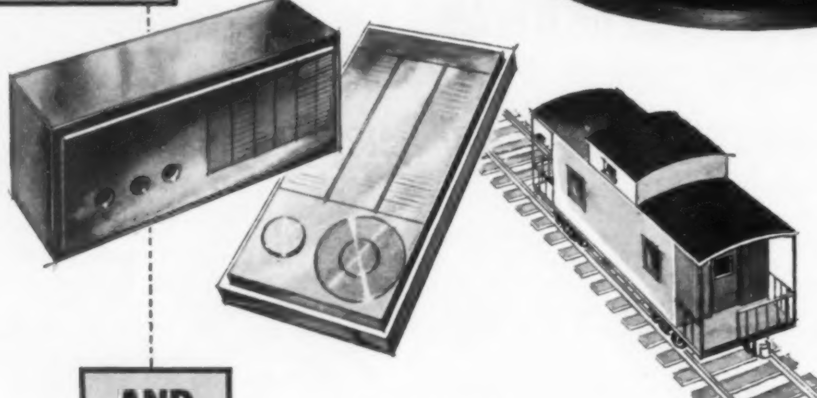

AND ...Columbian Costyreneblak offers many advantages. It's **CLEAN** . . . carbon black predispersed in chips that are relatively dustless. Clean-up time and chance of contamination are at a minimum. You get **FASTER COMPOUNDING** too . . . no pre-milling necessary . . . better dispersion, less rejects. Finally, Costyreneblak means **ECONOMY**. . . usually 25% less carbon black is required with this dispersion than when you use loose carbon black. Get all the facts . . . today.

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An unbreakable, lightweight dinghy . . . durable school furniture . . . traveling case . . . corrosion-proof water softener tank . . . crack resistant coated wire . . . rope that floats . . . detergent bottles . . . housewares . . . boilable frozen food packages . . . baby bottles . . . thick and thin packaging wraps and bags . . . stain-proof, durable rugs and fabrics . . . acid resistant, flexible and corrosion-proof pipe and tubing . . . non-conducting electrical conduit . . . biologically inert surgical gauze!

These and the other items shown above are a recent sampling of the wide variety of products made with MARLEX high density polyethylenes, ethylene copolymers, and Tailored Resins. In each case, MARLEX was chosen because its use either improved the product or achieved equal quality at less cost.

MARLEX is tough . . . rigid . . . colorful . . . strong . . . lightweight . . . non-allergenic . . . unbreakable . . . resistant to chemicals, oil, greases, rust, rot, corrosion, heat and cold (250°F to – 180°F). MARLEX items can be injection molded, thermoformed, extruded . . . machined, welded, and printed upon. In fact, no other type of material serves so well and so economically in so many different applications.

Perhaps MARLEX can serve you! If interested, contact us for further details and technical data on available MARLEX resins.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma, a subsidiary of Phillips Petroleum Company

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THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 1

May 1960

Polypropylene: more capacity—FDA approval—biaxially oriented film. For a material that is available only in limited quantities, polypropylene attracts unusual attention. Until this month, Hercules and AviSun capacity to produce was probably around 40 million pounds. Texas-Eastman has a semi-works plant in operation, and Humble Oil is ready to come in with 40 million lb. to be distributed by Enjay and Spencer. Dow should be ready with an estimated 10-million-lb. plant in Bay City, Mich. That's about all to be expected in 1960 despite the Rexall statement that both polyethylene and polypropylene would be available from them this year. Allied has been reported as a potential producer in the proposed 50- to 60-million-lb. Orange, Texas, plant which will be divided between polypropylene and polyethylene, but not this year. Foster-Grant has just been added as a new entrant.

There will be more in 1961 and 1962. Perhaps 300 million lb. more may be produced by the 10 companies now thought to be committed. And it should be pointed out that companies like Hercules, AviSun, and Humble have all stated that they have plans to add capacity as the market improves. Thus a 50-million-lb. capacity can be quickly expanded to perhaps 100 million on the same site. Each of the three mentioned expects to go over 100 million lb., but it may be several years before they reach that figure.

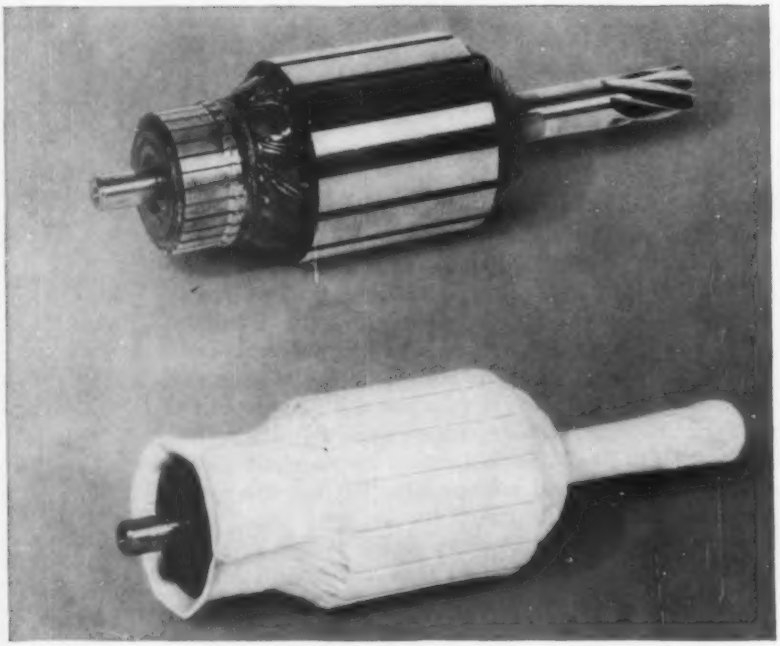
In addition there are now at least 11 other companies who have shown more than a passing interest in polypropylene production, but none is likely to start production on a big scale until late 1962 or 1963. No one seems worried about a complicated patent situation. Five companies are currently involved in "interference" claims, although only one of them is now producing commercial polypropylene in the United States.

Where will polypropylene be used? So far most of the polypropylene has been used for molding. Housewares is a logical field, but industrial moldings, even large auto instrument clusters for dashboards, look promising. Ease of molding, stiffness, impact and heat resistance are desirable properties. Monofilament for rope is a leading outlet today—may eventually obsolete even hemp and sisal. Ease of handling, light weight, strength, and durability are favorable factors. A large volume is expected to eventually move into the textile market. Its wool-like hand and ease of dyeing are important properties but it will probably take more time to develop this market. In Europe, polypropylene is counted on as an important future elastomer.

But the film makers seem most interested; at least they talk more about it than anybody. They think it may rival cellophane even at the present polymer price of 42¢/lb., although most analysts believe that price will eventually rival that of polyethylene, which is now discounted at 32½ cents. Some of the film makers thought to be already in or at least well along in development are AviSun, Chippewa, Kordite, Continental Can, Joanna (To page 43)

* Reg. U. S. Pat. Off.

CAMPCO PROGRESS / latest developments in plastic sheet·film·fabrication



This new method of insulating electrical components utilizes thermoplastic sheet

It hasn't been called "Skinsulation" yet but it well might. It's a new method of insulating electrical components by the use of epoxy resins and a skin of thermoplastic sheet. The idea was introduced by Minnesota Mining and Manufacturing Company and its advantages are so obvious that it is bound to find a great many applications. It has been demonstrated on various types of components using "Scotch-cast" Brand Resin and Campco thermoplastic sheet.

The above photograph shows how Campco thermoplastic sheet was vacuum-formed around the component. This becomes the mold form, eliminating the steel mold. An opening is made at the top through which lead wires may be brought out. Cardboard or tape is used to hold the wires in position.

Through this same opening, the resin is poured in until the mold form is completely full. The resin reaches the most remote area insuring complete coverage. The part is then ready for curing.

Simple, isn't it? It's efficient, too, for any number of articles of varying shapes and sizes can be skin-wrapped simultaneously. The size of the vacuum-forming machine is the only limiting factor, while with the present method production is limited to the number of molds that can be used on a production cycle.

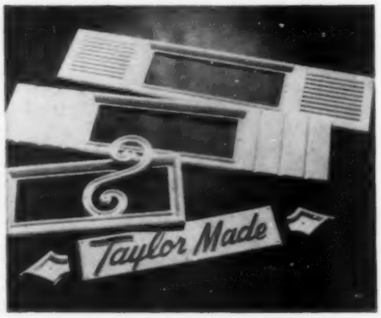
Dollarwise, there are worthwhile savings in labor and material. Where steel molds are now being used, increased production can easily be realized by making a number of vacuum molds from the master molds.

And here's another important advantage. Since by the new system production is not limited by the number of molds, presently used curing cycles may be completely changed. For example, in order to obtain three or four cycles per eight hour shift by the old method, resins must cure at 150° F. While, by the new system, a whole day's production can be cured overnight at a slower rate with the use of room curing or slower heat resins.

If you would like technical assistance or further information regarding this system, write Campco Division of Chicago Molded Products Corporation.

Garage doors decorated with Campco Butyrate

As a rule, a garage door is a rather dull and uninteresting piece of architecture. But Taylor Garage Doors, Inc., of Detroit have done something about it. Now their single and double garage doors can be decorated with numerous combinations of attractive trim in the form of shutters, windows, escutcheons, etc. Sold in kits for "do-it-yourself" application, the homeowner is provided



with the means of relief from the bare, flat planes of typical garage doors. They can be painted to match or complement the color of the door, require less repainting, and will not rot or corrode.

They are vacuum-formed by Taylor from Campco B-120 white opaque Butyrate, selected for its uniform thickness and consistent quality of whiteness.

Taylor finds that vacuum forming of Campco sheet affords an economical means of varying the designs without incurring the expense of carvings or metal stampings and finishing operations.

THE PLASTISCOPE

(*Continued from page 41*)

Western, Olin, Texas Plastics, Tupper, Dobeckmun, and, undoubtedly, Visking, although no statement has been forthcoming from most of them.

So far there has been very little film on the market, probably because of production problems that always cause trouble for a new product; also, markets have not been easy to woo away from cellophane with which it is competitively priced. But one producer says he is selling it to bread, paper products, and textile manufacturers for overwrapping.

FDA approval. Hercules has announced that the Food & Drug Administration has approved Pro-Fax 6520 (for film) and Pro-Fax 6513 (for molding and extrusion). They are special food packaging grades produced exclusively by Hercules. This is claimed to be the first packaging material to win approval through issuance of a formal Food Additives regulation and the petition submitted by Hercules is looked upon as a model to serve as a guide to other material producers. Polyethylene has not received formal approval, but was included in a list of materials that were granted an "O.K." extension until March 1961.

Shortly after the Hercules announcement, Dr. E. T. Severs of AviSun announced that his company's food grade polymer and film are qualified for use in food packaging under an FDA regulation which specifies, in Section 121.2501, those characteristics which polypropylene must possess before it can be used in contact with foods. He said that polypropylene possessing such characteristics had been under development at AviSun for over a year.

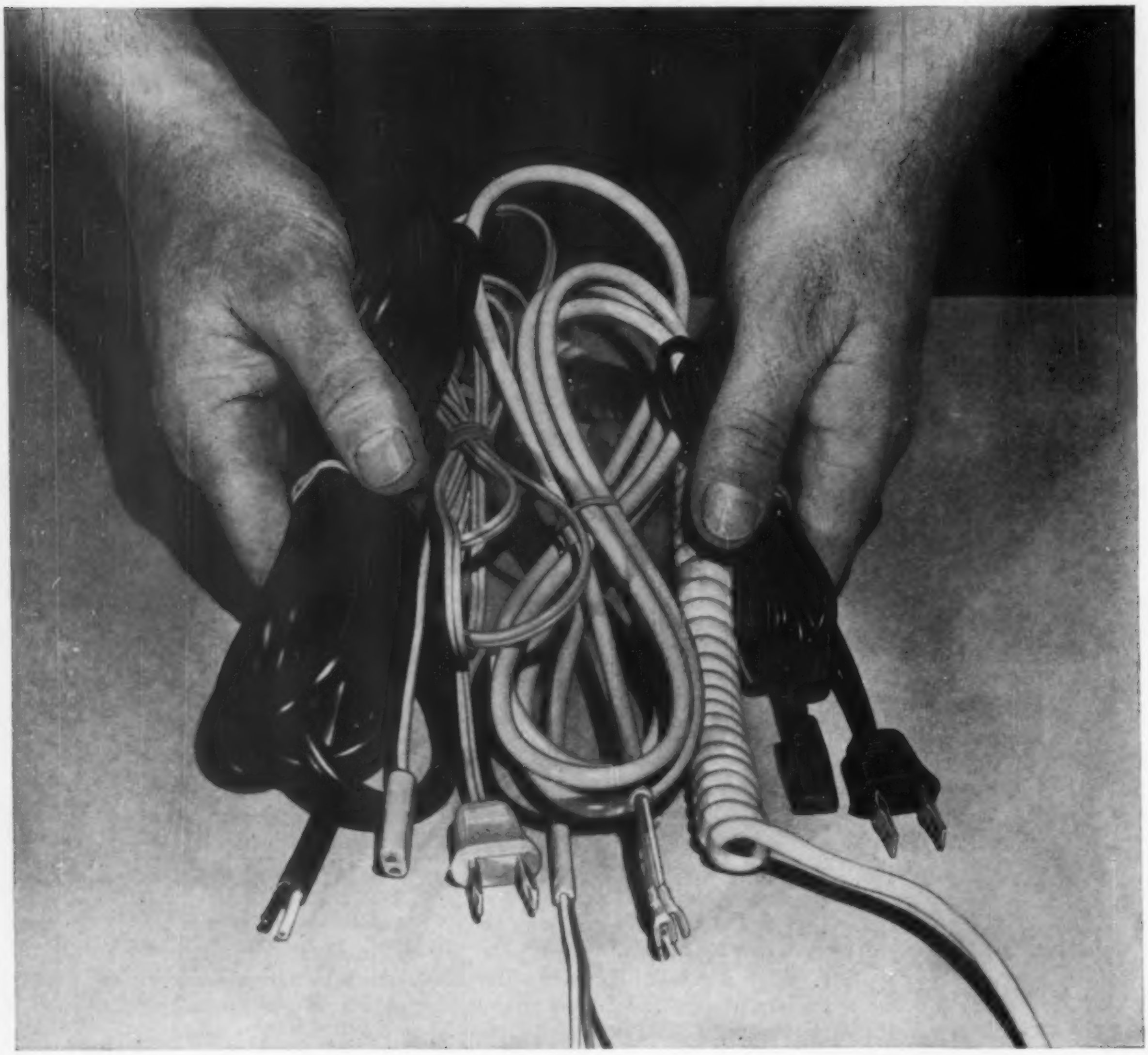
Biaxially oriented polypropylene film. Kordite Co. is now producing biaxially oriented polypropylene film that is claimed to rival cellophane in transparency and price. It is claimed that the double orientation, plus a special coating (which the trade guesses is some kind of vinyl—maybe vinyl acetate) makes it possible to heat-seal the polypropylene in high speed automatic machines. Kordite seems to be aiming for the cellophane and the overwrap market with a ½-mil material that can be handled on machines built for cellophane.

The coating is the key insofar as handling polypropylene on conventional wrapping machines is concerned. Double orientation gives strength, clarity, and other improved properties, but the heat seal would cause loss of orientation if applied directly to the film and thus ruin the superior properties. But when a coating is applied, the film is protected from the heat and only the coating is melted to form a seal. The coating also allows the seals to be peeled apart, thus facilitating opening of a package.

Company spokesmen point out that although the film is biaxially oriented, it is stronger in one direction than the other, which is both an advantage and a disadvantage, depending upon how the film is to be used. A film with almost equal strength in both directions may be available soon.

Humble Oil polypropylene plant on stream. The Humble Oil 40-million-lb. polypropylene plant is soon to come on stream. The material will be sold by Enjay and Spencer Chemical.

Enjay states that its polypropylene will be available in three melt indexes and that no choice of melt indexes has been offered pre- (To page 45)



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Chemicals for the rubber, paint, paper, textile, plastics and other industries: **GENTRO SBR** *rubber* **GENTRO-JET** *black masterbatch* • **GEN-FLO** *styrene-butadiene latices* • **GEN-TAC** *vinyl pyridine latex* **GENTHANE** *polyurethane elastomer* • **ACRI-FLO** *styrene-acrylic latices* • **VYGEN PVC** *resins* • **KURE-BLEND** TMTD *masterbatch* • **KO-BLEND** *insoluble sulfur masterbatch*

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VYGEN 85 — Recommended for calendering, extrusion and molding operations where processing at low temperatures is desired.

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VYGEN 110 — General purpose resin for calendered film, sheeting and coated fabrics molding and extruding. Excellent heat and light stability.

Creating Progress Through Chemistry

Chemical Division
GENERAL

(*Continued from page 43*)

viously. The melt indexes provided by Enjay will be 1½, 3½, and 5½, measured at 230° C. Because of easy flow, housewares could use 5½, combs would use 1½, but the best all-around molding material would be 3½. The melt index of polypropylene should in no case be compared with polyethylene, where MI for molding material ranges all the way from 4 to 30, with a testing temperature of 190° C. But Enjay points out a similarity: better flow and moldability improve as melt index rises, but the higher melt index materials must sacrifice some of the property advantages of a lower melt index.

The Humble Oil polypropylene is claimed to be the only polypropylene now produced on a continuous basis and, therefore, should be available with lot-to-lot uniformity.

Thermoplastic pipe for hot water. A new unplasticized vinyl chloride resin which will be used initially for production of either hot or cold water pipe in buildings will soon be announced by B. F. Goodrich Chemical Co. The introduction of such a material could mean as much to the vinyl industry as the introduction of plastisols 10 or 15 years ago, for heretofore it has not been possible to pipe hot water through any kind of thermoplastic pipe.

Up to now most data have indicated that rigid vinyl pipe is limited to carrying water at a maximum of around 140° F. at 125 p.s.i. continuous pressure. The new pipe may withstand temperatures at from 200 to 210° F. under continuous stress, around 60° F. more than the present Type I unplasticized material. Chemical resistance of Type I in the new formulation is increased to such an extent that this pipe can carry 93½% sulphuric acid at 210° F. Around 140° F. was the limit in previous vinyl formulations.

There will be at least two varieties to correspond with the conventional Type I and Type II PVC—one to emphasize chemical resistance, and the second to emphasize impact or toughness. The new material will probably be introduced at a price to compete with other pipe materials. It has been going through severe testing for two years or more, but is available only in semi-works plant quantity. A new plant will have to be built, and that may mean a year will be required before large volume is available. In the meantime its possibilities for sheeting and other extruded profiles will be investigated and developed as well as plasticized formulations to take advantage of its excellent electrical and heat deformation properties.

Licenses for biaxially oriented polyolefin pipe. One of the most talked about items at the plastics exposition in Düsseldorf was biaxially oriented polyolefin pipe developed in the laboratories of Farbwerke Hoechst and Reifenhäuser, the latter being an extruder manufacturer in Troisdorf, Germany.

Hercules Powder Co. has now obtained from Hoechst the exclusive right to license this development in the United States and Canada. The first non-exclusive licensee from Hercules in the U. S. is Reifenhäuser, who can now sell the extruder and the process in the U. S. to whomever it wishes. However, Hercules can license the process to interested parties regardless of the type of extruder they may wish to use.

The key to the process is the controlled orientation of the polyolefins at critical temperatures below their melting points. **(To page 47)**

(*Continued from page 45*)

Tenacity, impact strength, and low temperature properties of the polyolefin pipes are improved, and it is said that half the wall thickness of conventional polyethylene pipe is required in this new process to provide the same burst strength. (An explanation of the process and details on how it works were presented in "Report from Düsseldorf," in Dec. '59 Modern Plastics, p. 158.)

Progress in handling untreated polyolefins. The new Plastics and Chemicals Division of National Cleveland Corp., Bridgeport, Conn., is now offering two basic coatings, one for treated and one for untreated polyolefins. Each coating is available in various formulations suitable for brush and spray applications or roller and silk screen printing.

The material is formulated for use with polyolefin films, sheets, and foams, and is being used on a variety of injection and blow-molded products. Duck decoys, helmets, and imitation polyethylene bananas are examples of items where the new formulation has been used on treated items. Formulations for untreated materials, at present suitable only for rigid surfaces, are in use on detergent dispenser units and motor housings, both made of untreated polypropylene. Formulations for use on a rotogravure system for printing untreated low-density film are a definite possibility and may be on the market within a few months.

Pressure-sensitive adhesives, rotogravure inks, and polyethylene foam coatings are being developed under an arrangement with Flexabar Corp., Rockleigh, N. J., where original research is done.

Weather resistant polyethylene film. Eastman Chemical Products is now producing what is said to be the first stabilized polyethylene suited for film use. Film only 5 mils thick from this formulation has withstood two years of weathering with little loss of strength. It will be useful for greenhouses, mulches, silo and machinery covers.

The company also supplies a stabilized polyethylene formulation for injection molding and thick sheeting. A recent test showed a retention of 88% of initial elongation after three years of outdoor exposure. The company has also announced that its polyethylene line will henceforth include polyethylene of 0.941 density and higher, but did not state the origin of the high-density material which will be marketed. It probably won't be long before every polyethylene producer in the country will be offering a choice of any density resin regardless of whether he makes it himself or purchases it for redistribution.

Polyethylene football equipment. Rawlings Sporting Goods Co., St. Louis, Mo., is now producing shoulder cushions, blocking pads, and hip cushions for football players' uniforms from W. R. Grace's Grex high-density polyethylene. It will replace the fiber formerly used, and combines the advantages of impact strength, flexibility, body conforming, less cracking and high temperature resistance; it is also impervious to water and perspiration.

For additional and more detailed news see Section 2, starting on p. 202

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

Battle for material supremacy

Sir: The everlasting battle between the new and the old was never more in the minds of materials manufacturers than it is today.

Early misapplications established in consumers' minds the impression that *plastic* denotes cheapness and impermanence. For years no plastic was considered an acceptable material for products of any great worth. Thanks, however, to the tremendous advances made in the technology of plastics, and to the superb job done in re-educating the converters, the misapplication of these materials is far less common today.

As a matter of fact, I recently attended a meeting on product design development in the engineering department of a major manufacturing corporation. The problem at hand related to the material specified for a certain part, currently in the pilot-run stage. This part, made of a particular plastic, had been under-designed structurally. The part was flimsy—not due to any fault of the material, but to the engineer who designed it. One of the executives in charge of the program demanded that the material for the part be changed to a metal die casting, because the part had to *look and feel like quality.*

However, the story had a happy ending, since we were able to convince the executive that the material selection was correct, and that through redesign in certain areas the part in question could actually be made superior to the proposed die casting, plus the added advantage of a lower cost.

Nevertheless, I feel that there are still too many cases of the application of plastics to products they are not properly suited for. I am especially annoyed with the plastic garden hose. The stuff is fine in the heat of the summer sun; but try to rinse the salt off your car some winter day, and you have an unbending, rigid contraption that soon finds its way to the trash can. The educational job is one for which there is no end in sight.

Today, the industrial designer is being called on with increasing frequency by materials producers to perform this educational service.

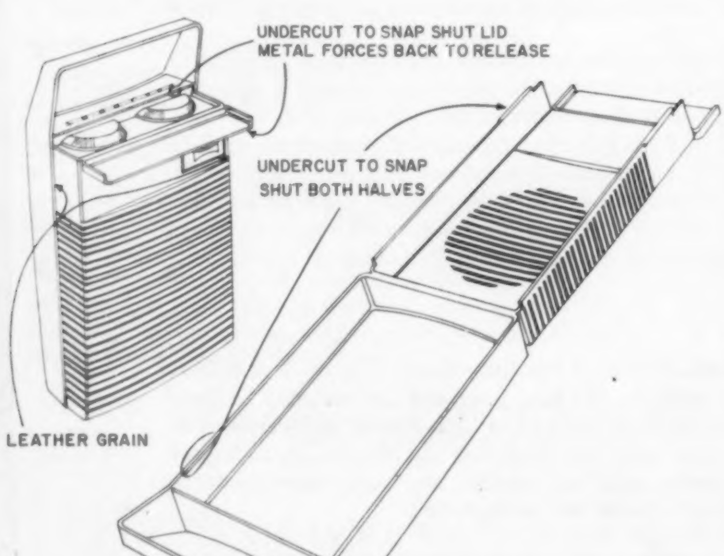
My own firm can speak with a certain degree of authority on the materials question, since we are retained by three major producers—in metals, in paper, and in plastics—to advise them on design problems. For example, in a design project, directed toward developing new uses for polypropylene with a better realization of some of the potentials of that material, we developed a new pocket radio housing (see drawing, below). The housing features a complete case, control cover and speaker grille, all created in a one-shot molding, instead of being made the usual way, as separate parts. The inherent properties of the material, which permit hinging, were exploited fully in the new design.

The plastics industry, in its never-ending quest for newer and better answers to old problems, has opened countless doors of design opportunity to the industrial designer. But it is often difficult for the consumer, after having been educated to the merits of the old materials, to accept these new ones. To him, the differences are almost impossible to discern. In many instances he just does not care as long as the material performs functionally, looks good, and lasts a reasonable length of time.

It is here that the industrial designer through a detailed evaluation of such factors as price, color, availability, and fabrication methods can perform an invaluable service in the material selection.

David E. Scott

Sundberg-Ferar Inc.
Detroit, Mich.



Vinyl foams omitted

Sir: It has come to our attention that the chart on self-extinguishing plastic materials which you recently published did not contain any reference to vinyl foams.

In view of the fact that vinyl is one of the more important of the self-extinguishing foam plastics, we would like through the medium of this letter to correct this omission. I would suggest that your readers add the following information to their charts under the classifications indicated: Manufacturer, Union Carbide Plastics Co., 796 Frelinghuysen Ave., Newark, N. J.; Tradename and number, Vinylfoam; Type of resin used, Vinyl; Tests passed, ASTM D1692, SPI test, MIL-R-0020092C (Ships) Class I; Specific gravity, Controllable between 3.0 and 20 pcf; Heat distortion points °F.; Approximately 220° F. @ 0 load; Light stability, Excellent; Colors available, Wide range.

Henry E. Allen, Mgr.,
Vinyl Foam Div.

Union Carbide Plastics Co.
Newark, N. J.

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Especially for injection molding up to 1½ ounces involving inserts or loose cores

Super Eldorado MINI-JECTOR

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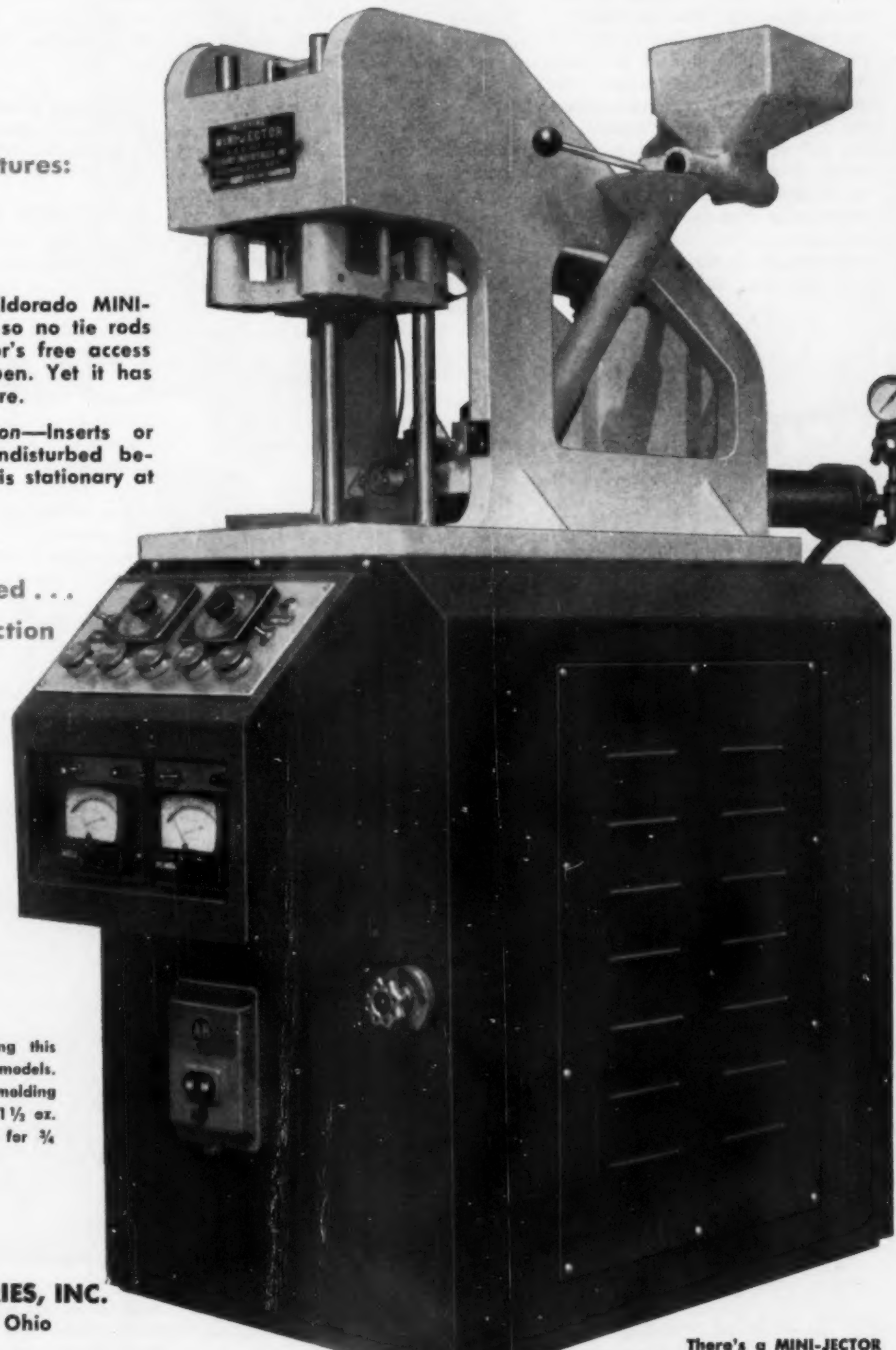

Outstanding Features:

***No Tie Rods in Way*—Eldorado MINI-JECTOR is engineered so no tie rods in front hinder operator's free access to mold when it is open. Yet it has ample clamping pressure.**

***Vertical Clamp Operation*—Inserts or loose cores remain undisturbed because bottom of mold is stationary at all times.**

economy . . . speed . . . in volume production

Write Today for

FREE 56-page catalog describing this and all other MINI-JECTOR models. MINI-JECTORS solve injection molding problems from sub-miniature to 1½ oz. Prices start from under $1,000 for ¾ oz. model.

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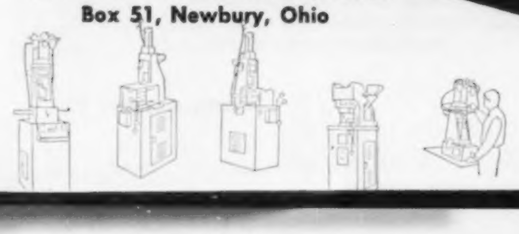


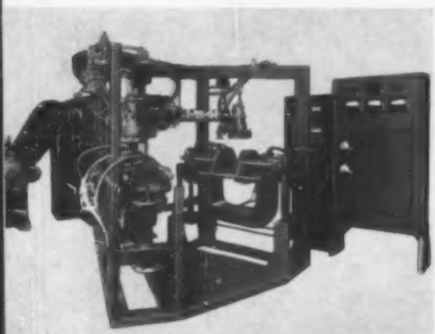
There's a MINI-JECTOR to solve your injection molding problems

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Blow molding machine

The MPM Diversamatic Model V-21 twin-station blow molding machine has a specially designed V-type manifold to help eliminate the pressure loss occurring due to the 90° turn material must make in manifolds of right angle design. The machine will produce parisons ranging in outside diameter from 1/4 to 6 1/2 inches. Maximum dimensions of molds that can be handled are 36 by 21 inches. Daylight is 28 in. and mold clamp stroke is 12 inches. The machine can be run completely automatically or manually for set-up and test runs. Either different or identical molds can be run at the same time and each leg of the manifold has independent temperature controls. Both single cavity and vertically strung molds can be run, and if desired only one station of the machine can be used to run a single mold. The entire blowing machine is air operated and requires 15 cu. ft./min. at 135-200 p.s.i. line pressure. Production capacity of the machine is shown in the table below. Dimensions of the blow molding machine are 95 by 65 by 80 in. and the control cabinet (without extruder) is 36 by 15 by 6 inches. Power of 9500 w. at 230 v., 3 phase, 60 c.p.s., a.c. is required. The blow molding machine can be supplied as a package with 2 1/2, 3 1/2 or 4 1/2 in. MPM extruders with specially designed screws for blow molding. L/D ratios of 20:1. *Modern Plastic Machinery Corp., 64 Lakeview Ave., Clifton, N. J.*



MPM Diversamatic Model V-21 blow molding machine has four tie bars on each molding station to insure positive mold alignment.

Production capacity of the MPM Model V-21 twin-station blow molding machine[a]

Round container capacity	*Resins per container*	*Units per hour*
fl. oz.	*g.*	
2	4	1500
4	7	1500
6	9	1000
8	12	900
12	18	850
16	24	850
24	34	750
32	44	650
64	90	520
128	150	350

[a] Test run with a 2 1/2-in. extruder.

Cylinder printer

Designed for printing on cylindrical plastic surfaces such as pen barrels and vials, the Apex automatic cylinder printer will handle one or two color decorating jobs. It has an automatic hopper feed and conveyor take off and will produce 2500 pieces per hour. The unit can be adjusted for different sizes of tubing and prints one or more lines at the same time on a portion of, or the complete surface. *Apex Machine Co., 14-13 118th St., College Pt. 56, N. Y.*

Air cooled extruder

Air-cooled models have been added to the Egan line of extruders. The units which will be a supplement to the Egan extruders equipped with the patented "Willert Temperature Control System," are to be used where the need for dissipating excessive heat is not severe. The cooling system consists of three 1/3-hp. blowers with duct work arranged so that uniform air flow may be achieved around the full circumference of the cylinder at high velocities. These blowers are automatically controlled by the three-position proportioning type indicating temperature controllers. Production rates for these new extruders will be the same as obtained with units having the Willert System. Typical rates on the extruders are: 300 lb./hr. on the 3 1/2 in. and 600 lb./hr. on the 4 1/2 in. models, when extruding high impact styrene sheet. The longer models with a L/D ratio of 24:1 are capable of rates at least 15% greater. *Frank W. Egan & Co., S. Adamsville Rd., Somerville, N. J.*

* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

Compression press

The 25-ton Model 359 D combination transfer and compression molding press is a hydraulically actuated straight ram type, self-contained press with heavy duty construction. Adjustment of each step in molding cycle, including breathe open and breathe dwell is provided. Press frame is compactly mounted on a console type housing, inside of which is contained the hydraulic oil reservoir (hydraulic oil not supplied) pump, motor, and all necessary piping, solenoid valves, and hydraulic components. Press controls are positioned on the console. Specifications: maximum clamp, 28 tons; maximum transfer, 7 tons; die space, 18 by 18 in.; ejector rod spacing, 17 in.; clamp ram stroke, 6 in.; transfer ram stroke, 6 1/2 in.; maximum pressure, 2000 p.s.i.; maximum daylight, 21 inches. Press speeds in **(To page 52)**

HULL Model 359D combination transfer and compression press has all controls mounted on console cabinet.

"COMPLETE AUTOMATION"

Prominent toy manufacturer operates their fully automatic Van Dorn 3 oz. presses 24 hours per day, 6 days per week. They also report their Van Dorn presses substantially reduce cycle time, are economical, versatile, and require minimum maintenance.

Model H-300

GAIN 3 WAYS with VAN DORN Presses

Model H-400

Model H-260

"PACKAGE SERVICE"

The user of this Van Dorn 4-6 oz. press had a well conceived idea for a plastic part, but no molding experience. So they had Van Dorn engineers help them procure a well designed mold from a competent moldmaker; then checked the operation of the finished mold on a Van Dorn factory demonstration unit. This free Van Dorn "Package Service" insures satisfaction, helps produce profits.

"25% LESS CYCLE TIME"

This is the report of a progressive custom molder about his Van Dorn 2½ oz. presses. He also says that they "give fast set-ups, and less waste in purging from one material to another. Van Dorns are extremely fast, versatile and economical."

Write for Illustrated Specification Bulletins on these Van Dorn Plastic Presses.

Van Dorn

THE VAN DORN IRON WORKS CO. • 2685 EAST 79TH STREET • CLEVELAND 4, OHIO

NEW MACHINERY

(From page 50)

in./min. are: Closing speeds, Clamp 190, Transfer 388; Pressing speeds (adjustable), Clamp 0 to 25, Transfer 0 to 82; Return speeds; Clamp 192, Transfer 500. Prices, without heating or heating controls, range from $4780 to $7515, depending on complexity of desired operating features. Delivery for the press is approximately 10 to 12 weeks. *Hull Corp., Hatboro, Pa.*

Saw sharpener

A useful machine for plastics fabricators using carbide tipped saws in their manufacturing operations is the Vollmer Model ASHK-1000-A automatic carbide toothed saw blade sharpening machine. Once the controls have been set the machine goes through the entire sharpening operation without the need of an operator. The machine will grind the tooth face, or top, straight or with an alternate face or top bevel. The machine will handle saw diameters from 5 to 40 in. with tooth distances up to a maximum of 4 inches. Operation is fast; for example, it takes 12 min. to resharpen a carbide tipped blade 14 in. in diam. with 42 teeth (straight tooth face and alternate top bevel of 15°). *W. Von Arnauld Co., 95 Grove St., Oakland, N. J.*

Purging compound

Called A-C cleaning compound, this low-melt-index plastic material is designed to completely remove any thermoplastic from extrusion and injection cylinders. The compound is placed in the hopper and fed behind the plastic to be purged and the machine is operated under normal operating temperatures to keep the plastic from being purged molten. The actual amount of material needed to clean the cylinder will vary with the size of the cylinder and the amount of contamination present. *Allied Chemical Corp., 61 Broadway, New York 6, N. Y.*

Blow molding machine

The Newark-Granbull blow molding machine is now ready for commercial use. An agreement has been completed with Owens-Illinois to operate under the Bailey Patent No. 2,810,934, which gives Newark the right to offer sub-licenses to the purchaser. Carl Holmes, formerly with the Plastic Div., General American Transportation Corp., has joined Newark as manager to act as liaison with the associated company, the Newark Die Co., which specializes in design and construction of blow molds and auxiliary equipment, as well as dies for the compression, injection, and extrusion phases of the industry. *Newark Plastic Machinery Corp., 22 Scott St., Newark 2, N. J.*

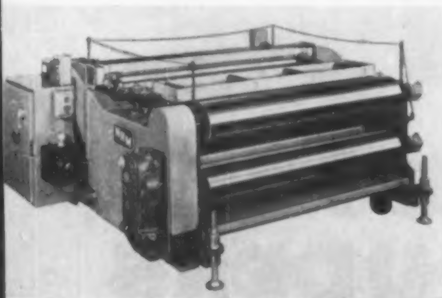
Film casting unit

For operation at speeds up to 500 ft./min., this unit is designed for high speed, efficient casting of 0.0005 to 0.010 in. conventional or linear polyethylene, polypropylene, or nylon film in widths from 36 to 72 in. or wider on request. Suitable for installation of a built-in electronic treating device, the machine can produce high-clarity film, ready to print when so modified. Rolls are spiral baffle liquid-chilled, chrome plated and highly polished for production of blemish-free film. Dynamic balancing of all rolls assures vibration-free, true running at highest processing speeds. All idler rolls are drilled for optional liquid cooling. Also included are turret-type wind-up with constant tension wind-up control, automatic hot knife cut-off and transfer, variable width knife slitting and an integral trim collector or granulator. **(To page 54)**

NEW MACHINERY-EQUIPMENT

(From page 52)

Controls are self-contained, located on the turret end and one side of the machine, within easy reach of the operator. The unit is low and accessible to facilitate thread-up . . .



NATIONAL RUBBER MACHINERY film casting unit can be either floor or track mounted for flexibility.

height is adjustable to permit its use with various extruders. *National Rubber Machinery Co., 47 W. Exchange St., Akrpn 8, Ohio.*

Coloring device

Costing only $25, simple device permits color coding of any type of wire coated with polyvinyl chloride, at speeds up to 400 ft./min. Wire is reeled in from supply roll or extruder, immersed in dye container, and rewound, dry to the touch within one second. Rapid drying is the result of using Du Pont Freon-MF solvent in the dye solution. Dye device can be affixed by clamps to any convenient shelf or table top. A more elaborate wire coating machine, costing about $75, permits striping wire with two colors of dye. Colors are applied from two small containers and wire, then is twisted on separate twisting machine to give color spiral effect. Counter automatically measures wire. Colors can be changed by simple substitution of dye containers. *Spectra-Strip Wire & Cable Corp., P. O. Box 415, Garden Grove, Calif.*

Foam dispenser

Designed with operating simplicity in mind, this machine for producing urethane foams has all components mounted integrally in one unit. Four models are available; RA-I, RA-II, RA-III, and a laboratory model. Variable outputs in the same order are ½ to 4 lb./min. with a 10-gal. capacity; 5 to 15 lb./min. with a 20 to 30 gal. capacity; 16 to over 50 lb./min. with various capacities on request; and outputs up to 5 lb./min. on laboratory models for evaluation and development work. Both recirculating or direct delivery types can be supplied with either a fixed or portable mixing head arrangement. Power requirements are 220 or 440 v. 3-phase electrical supply, and an air supply of at least 75 p.s.i. Mounted on casters, the unit comes with automatic timer for setting dispensed foam weight, tachometers, blow meters, temperature indicators, fail-safe electrical circuits, and push button operated flash system. *Rogers Associates Inc., Box 752, West Caldwell, N. J.*

Vacuum forming machines

Tote boxes, refrigerator liners, and other large parts up to 4 ft. by 6 ft. by 24 in. deep, may be formed from 0.060-in. and heavier gage materials on the MV-2 series of machines which uses twin heaters, with independent time and temperature controls. The heaters are close to the clamp frame for fast heating at low power. The bottom heater automatically retracts at the moment of material sag, while the top heater heats to final temperature. Neither the heating nor the cooling cycles need to be equal.

A clam-type air clamp grips only a ½ in. perimeter with 200 lb. per linear inch. Frames are adjustable for different material thicknesses. The machine may be used for forming on the lower platen or upper platen. Any of the following forming methods and combinations may be set up; straight vacuum, drape, snap back, air cushion/plug, plug/drape, and slip ring. Parts with a grained finish may be formed on MV-2 machines from plain sheet plastic. The finish is put in the mold surface. Automatic mechanical clamps lock the mold, permitting the use of air pressure up to 40 p.s.i. through the plug. This added pressure, forces the formed plastic against the mold picking up the surface grain. The MV-2 series includes two lines of machines with forming areas 30 by 50 in., 42 by 72 in. or 48 by 72 inches. The MV-2-16 and MV-2-24 lines have maximum draws of 16 and 24 in., respectively. *Auto-Vac Co., a div. of National Cleveland Corp., 1984 State St. Ext., Bridgeport, Conn.*

Printability tester

A machine devised to measure the printability of polyethylene film may also find practical value in determining how well polyethylene will adhere as a coating on other materials. The machine, designated the McLaughlin Tilting Platform Tester, was originally designed by Mr. McLaughlin as an accurate, yet economical, way to determine how well polyethylene resin will accept printing ink. A small sample of film is clamped in a holder in horizontal position and a drop of distilled water is placed on it. An enclosed motor, at the push of a button, tilts the platform at the rate of one degree per second, the operator halting it when the droplet begins to flow. The degree of tilt is read on a scale at the end of the test. This angle is proportional to the forces of attraction between the drop of water and the film. These forces are related to degree of polarity, or surface oxidation, and printability of the material —acceptable printability beginning, according to Mc- **(To page 56)**

AUTO-VAC'S double heater MV-2 vacuum forming machine showing directional cooling ducts and plug mounted on upper platen. Deep drawn part is shown being removed from mold.

Best source of Service on Plastics . . .

AUTHORIZED PLEXIGLAS DISTRIBUTORS

There are one or more Authorized PLEXIGLAS® Distributors at every city shown on the map. This means convenient service no matter where you are located. In addition to complete service on PLEXIGLAS acrylic plastic, your Authorized PLEXIGLAS Distributor can serve you with other plastics and a wide range of accessories. He makes prompt deliveries. He is qualified to help you with fabrication and technical information. His stock includes almost any size and thickness of PLEXIGLAS in clear, colored, patterned and corrugated sheets. Look for his name under PLEXIGLAS in the Plastics section of telephone directories in major cities.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

In Canada: *Rohm & Haas Company of Canada, Ltd., West Hill, Ontario*

NEW MACHINERY-EQUIPMENT

(From page 54)

Laughlin Tester measurements, at about 30 degrees. Priced at about $200, the McLaughlin Tilting Platform Tester is being produced, on order, by the *Precision Mach. & Develop. Co., New Castle County Airport, Wilmington, Manor, Del.*

Injection machine

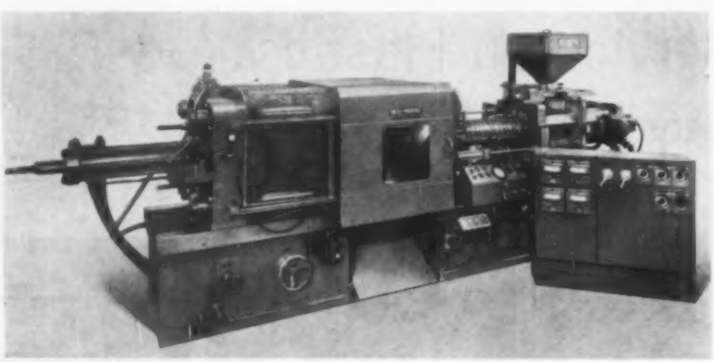
More clamping capacity, faster cycling, larger die space, and longer stroke are the main features of a new series of 12/16-oz. Reed-Prentice plastic injection molding machines. An exclusive monitor-type safety circuit (patent applied for) affords operating safety. If any part of the safety circuit fails, the machine will open and stop. Also, once the safety gate has been closed, the operator is kept out of the press until it is safe. Mold setup and space adjustments are hydraulic. Hydraulic movement of the plunger housing avoids possible nozzle breakage in setting up. Proportioning pyrometers and timers are housed in a separate cabinet. Plug-in type heating bands and thermocouples are used. Other specifications are given in the table at the bottom of this page. *Reed-Prentice Div., Package Machinery Co., E. Longmeadow, Mass.*

Resin mixer

Low-cost, completely self-contained and self-supporting drum-type resin mixers have a disk type blade which shears in and disperses solid materials rapidly with a minimum of air entrapment. A bottom-to-top blending action effects a uniform mix, and the low-heat build up lessens "kick-over" hazard. A counter-balanced motor can be cranked up or down for easy loadings. The mixer is available in three horsepower ranges and three disk diameters. Motor and motor starters are explosionproof designed to operate in Group D hazardous atmospheres as defined in the 1956 edition of the National Electrical Code, Chapt. 5, Art. 500, Sect. 5.002. Specifications as well as prices on the three resin mixer models available are shown in the following table:

Disc type			
blade dia., in.	6	9	12
Model No.	40-003	40-002	40-004
Recommended motor size, hp.	3	5	7½
Height, in.	106	108	110
List price	$1820	$1915	$2200

Equipment is particularly suitable for reinforced plastics plants. *Dake Corp. Grand Haven, Mich.*



REED-PRENTICE 350 TC-12/16 oz. injection molding machine has new swing out hopper for easier cleaning and material changeover.

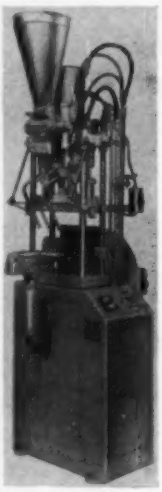
Specifications: Reed-Prentice 12/16-oz. injection machines

	Model		
	350TCL-12/16	*350TC-12/16*	*450TC-12/16*
Plasticating capacity, lb./hr.[a]	150	150	150
Dry cycles/hr.	465	535	—
Displacement rate, cu. in./min.	1360	1360	1360
Adjustable clamp stroke, in.	8½ to 20½	7½ to 14½	6 to 22⅝
Clamp force, tons	372[b]	356[b]	450
Mold platen size, in.[c]	32½	32½	40
Distance between tie bars, in.	20½	20½	26
Diam. of tie bars, in.	4	4	5
Max. daylight, in.	44¾	36½	47⅛

[a] 180 lb./hr. capacity optional. [b] SPI Strain Gage value. [c] Platens are square on all models.

Automatic transfer press

Specifically intended as a low-cost unit for use on short production runs where low mold costs and quick set-up are desired, 25-ton air-operated automatic transfer molding press, Model 725, also provides the labor-saving advantages of automatic molding. It is easily converted from automatic transfer molding to automatic compression molding, and it can be operated either fully - automatic, intermittently, manually or semi-automatically. Press operates with direct power feed by means of an easily adjustable three-station rotary feeder. An air supply with 100 p.s.i. working pressure is ample. The force of the air-cylinder is multiplied by a toggle arrangement to develop the 25-ton clamping force and provides fast closing and opening action. A 5½-ton maximum transfer force is obtained by means of a separately adjustable air cylinder. The unit is supplied with both top and bottom ejection systems, and has an air-operated blow-off device. Other specifications: clamp stroke, 5 in.; transfer stroke, 2½ in.; ejection stroke (top and bottom), 2½ in.; hold-down pin stroke, 1¼ in.; daylight, press open, 22½ in.; daylight, bed plate to ram with press closed, 12 to 17 in.; platen size, 11½ by 6 in.; minimum dry cycle time, 5 seconds. *F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.*



Correction

"New Machinery-Equipment" (MPl, Feb. 1960, p. 48): The T. H. & J. Daniels Ltd. low-pressure molding press shown is 30-ton model.—End

More and more 'Perspex' is being used in modern cars

IN modern cars great use is being made of 'Perspex' acrylic sheet—are you making full use of this truly outstanding material? 'Perspex' offers excellent clarity in clear form as well as an extremely high degree of light transmission in tinted form. It is light in weight and it can be formed to smooth, modern streamlined shapes. Another great advantage 'Perspex' offers is toughness. It has long been established that 'Perspex' stands up to weather conditions throughout the world. Finally, 'Perspex' is a handsome, long-lasting material, a material modern car owners are glad to have in their cars.

Heinkel car sold by International Sales Ltd., showing side windows and rear dome made from 'Perspex' acrylic sheet by P.D.I. Ltd., Birmingham.

Sliding side windows made from 'Perspex' acrylic sheet by Coventry Hood and Sidescreen Co. Ltd., Bedworth near Coventry, in Triumph car manufactured by The Standard Motor Co. Ltd.

'Cyclone' weather shield made from 'Perspex' acrylic sheet by Cyplas Industries (England) Ltd., Colne, Lancs, on Morris Minor 1000.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

P.759/O/A

Imperial Chemical Industries Limited, Plastics Division: Export Dept., Black Fan Road, Welwyn Garden City, Herts.

U.S.A. *enquiries to:* J. B. Henriques Inc., 521 Fifth Avenue, New York 17, N.Y.

Canadian enquiries to: Canadian Industries Ltd., Plastics Division, Box 10, Montreal P.Q.

WORLD-WIDE PLASTICS DIGEST*

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Research progress in dielectrics—1959. A. E. Javitz. Elec. Mfg. *65,* 60-70 (Jan. 1960). This is a report of the 28th Annual NAS-NRC Conference on Electrical Insulation. A new polyamide type resin with good thermal stability and high nuclear-radiation-resistant properties is described; over 50% of electric strength is retained after 3 wk. at 300° C. A method is presented for measuring the electric strength of plastics at temperatures up to 500° C. Measurements of the conductivity of polystyrene film under relatively high electric fields, and field effect on the conductivity are reported. Results of studies on the time delay for electric breakdown of polyethylene at 3300 megacycles are discussed.

Polyvinyl alcohol capacity to rise. Chem. Eng. News *38,* 32, 34 (Feb. 8, 1960). Statistics on production and uses of polyvinyl alcohol are presented. Production is expected to rise 115% in the near future. Principal uses are in adhesives, paper coatings, packaging film, and fibers.

How to specify molded plastics parts. R. L. Miller. Materials in Design Eng. *51,* 94-97 (Jan. 1960). Specifications for plastics parts must cover the basic resin, the part design, and the performance. The resin specification should identify the material and describe the quality tests that the resin must pass. The design specification should include detailed drawings with critical tolerances, finishes, and parting lines. Suggestions to reduce the cost of the part are given. These include the use of reworked material, the restricted use of close tolerances, parting line placement, etc. Performance specifications should be set up on a statistical control sampling basis and include visual inspection as well as physical tests. Sample specifications are given.

Materials

New high temperature epoxy resin. Materials in Design Eng. *51,* 9-10 (Jan. 1960). A new epoxy resin for use at high temperatures is described. Heat distortion temperature values on unreinforced specimens show higher values than those obtained with conventional epoxies. Mechanical properties are similar to those of other epoxy systems and the electrical and chemical properties are somewhat improved. The new epoxy can be heated to temperatures substantially above the heat distortion temperature without rupturing. Initial uses will be in glass-fiber-reinforced laminates, high-temperature-resistant protective coatings, and adhesives.

Organotin polymers. D. A. Kochkin, V. N. Kotrelev, M. F. Shostakovskii, S. P. Kalinina, G. I. Kuznetsova, and V. V. Borisenko. Vysokomolekuliarnye Soedineniia *1,* 482-84 (Mar. 1959). Polymers are obtained from trialkylstannyl methacrylates and dialkylstannyl dimethacrylates. A more detailed description is given of polytriethylstannyl methacrylate and its copolymers with various monomers. In addition to this, some data are presented on the thermomechanical and physicomechanical properties of these products.

Stable furfuryl alcohol impregnating solutions. I. S. Goldstein and W. A. Dreher. Ind. Eng. Chem. *52,* 57-58 (Jan. 1960). Storage-stable monomeric furfuryl alcohol solutions which give high yields of furfuryl alcohol resin when heated are prepared by using zinc chloride or organic acids such as tartaric, citric, and malic as catalysts. These solutions of low viscosity are used to impregnate such fine-pored materials as wood, brick, and carbon to increase their chemical resistance and improve their physical properties. These resin-impregnated materials give considerably better service in chemical process equipment against both acid and alkali than the same materials when untreated.

Plasticizers from tetrahydrofurfuryl alcohol. L. H. Brown and J. W. Hill. J. Chem. Eng. Data *5,* 56-58 (Jan. 1960). Di(tetrahydrofurfuryl) sebacate and tetrahydrofurfuryl decyl sebacate are more efficient plasticizers for PVC than di(2-ethylhexyl) phthalate. As much as 20% of di(2-ethylhexyl) phthalate can be replaced with tetrahydrofurfuryl oleate in a vinyl formulation without loss of efficiency or ultra-violet stability. Although the specimens lack complete ultra-violet stability, a tetrahydrofurfuryl-tall oil fatty acid ester replaces up to half of the di(2-ethylhexyl) phthalate in a vinyl formulation with no loss of efficiency. Di(tetrahydrofurfuryl) phthalate, di(tetrahydrofurfuryl) azelate, di(tetrahydrofurfuryl) adipate, di(tetrahydrofurfuryl) diglycolate, di(tetrahydrofurfuryl) succinate, and 1,2,5-triacetoxypentane appear to be better solvents than dibutyl phthalate in preliminary screening tests that were conducted on cellulose triacetate.

Molding and fabricating

Manufacture of clear film from high-density polythene by water bath quenching. E. Overgage and G. John. Brit. Plastics *32,* 512-15 (Nov. 1959). The equipment and processes used in making clear film from high-density polyethylene are described. Data are presented on the various physical properties of the water-quenched film.

Winding-up and winders. H. Bothe. Kunststoffe *49,* 583-85 (Oct. 1959). The requirements of winding-up equipment are outlined. The different types of haul-off and winding equipment on the market are classified and described.

Some fundamental aspects of fluidized bed coating. J. Gaynor. SPE J. *15,* 1059-63 (Dec. 1959). Three useful coating techniques employed in fluidized bed coating are described, including the use of preheated parts, electrostatics, and adhesive undercoating. The basic principles of this method of coating are discussed. Some consideration is also given to proper safety precautions that are required in the handling of flammable powders.

Applications

New boost for plastic pipe. Chem. Week *86,* 108, 110 (Feb. 20, 1960). A new plastic pipe design consists of a glass-reinforced shell lined with a PVC-rubber blend. This gives higher strengths and greater resistance to heat.

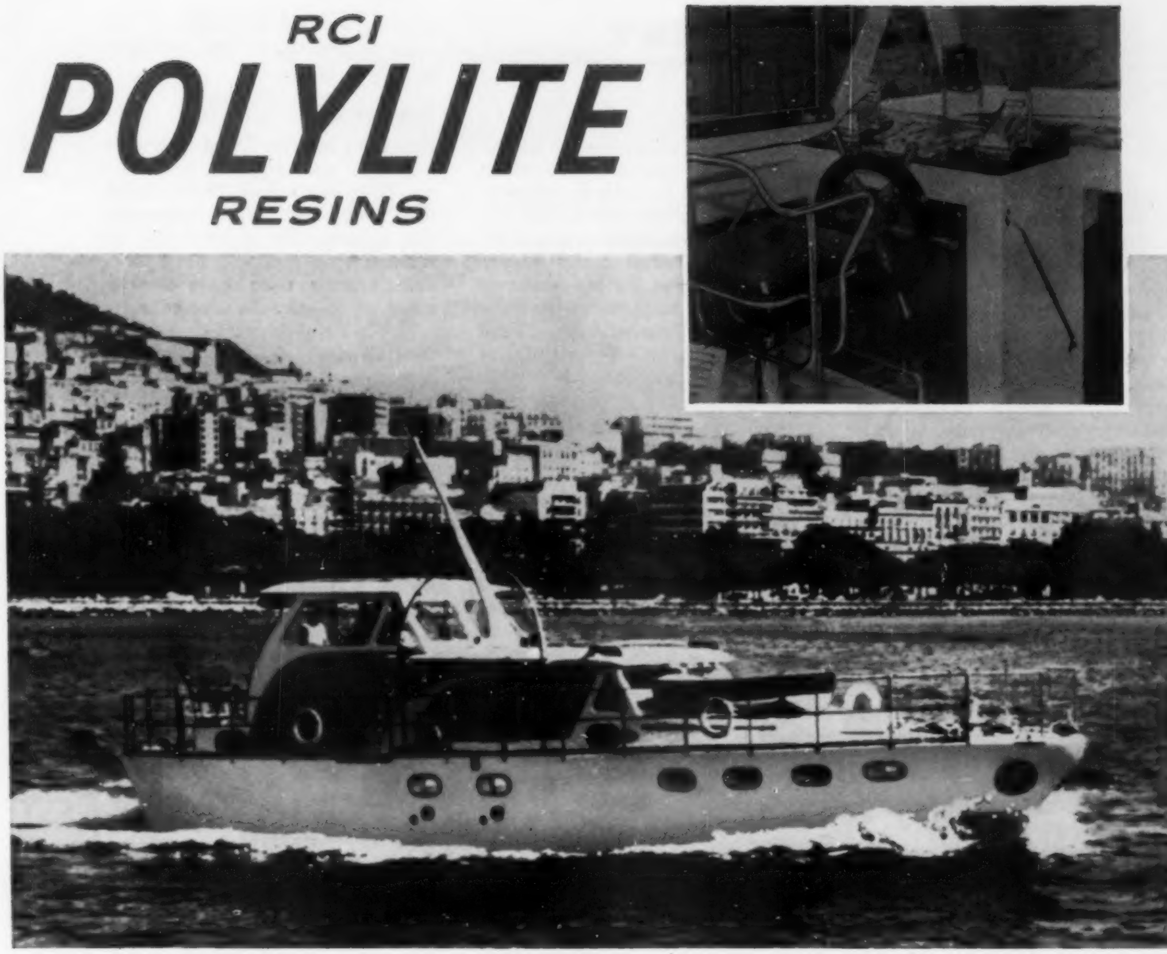
Improved epoxy-resin system for electronic embedments. B. H. Mueller and C. A. Harper. Elec. Mfg. *65,* 119-22 (Feb. 1960). The use of liquid anhydride **(To page 60)**

* Reg. U.S. Pat. Off.

RCI

POLYLITE

RESINS



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● This is the custom-made "CELUANC", built of glass fiber reinforced polyester — by Resine Sintetiche Ed Affini, Naples, Italy.

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Ortho-Phenylphenol • Sodium Sulfite • Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate • Sulfuric Acid • Methanol

PLASTICS DIGEST

(From page 58)

curing agents with epoxies imparts to the cured resin many of the desirable low-temperature properties and many of the high-temperature properties previously obtained only with solid anhydrides. The liquid anhydrides are easy to handle and are non-toxic. Various epoxy-curing agent combinations were tested for thermal shock, water loss at elevated temperatures, heat distortion temperature, flexural strength, insulation resistance, and electric strength. Of the curing agents tested, two were selected as providing the optimum combination of properties for the development of a "universal" embedment compound. Results of a year's manufacturing experience with one of the systems is described.

Evaluation of special-purpose adhesives. Elec. Mfg. 65, 125-30 (Jan. 1960). The properties of 23 commercial adhesives and their applications are given in tabular form. A neoprene bonding chart listing primers, adhesives, cure schedules, and bond evaluation for various systems is also given.

Teflon bids anew for CPI piping dollars. Chem. Week 86, 101-02 (Feb. 27, 1960). The properties and economics of Teflon-lined steel pipe are compared favorably with glass-lined steel pipe and Monel pipe.

Properties

Effects of corona discharge upon polyethylene. R. F. Grossman and W. A. Beasley. J. Appl. Polymer Sci. 2, 163-65 (Sept.-Oct. 1959). Supporting evidence for the degradation of dielectric materials by corona discharge is obtained by correlating the maximum radius of oxidized product, oxalic acid, produced by corona discharge from a spherical electrode upon polyethylene, with the theoretical range of electrons produced. Rationalizations concerning the formation of oxalic acid in the process are offered.

Amorphous structures of polyamides. T. M. Frunze, V. V. Korshak, and V. A. Makarkin. Vysokomolekuliarnye Soedineniia 1, 342-48 (Mar. 1959). The relation between the structure of mixed linear polyamides and their capacity for forming amorphous structures on quick cooling (quenching) of a polymer melt at temperatures ranging from −70 to +70° was investigated. The tendency to form amorphous structures on quenching increases in the mixed polymers with decreasing regularity of structure of the macromolecules. The amorphous structures of the polyamides obtained in this manner are stable only at low temperatures; elevating the temperature leads to gradual crystallization. The presence of water facilitates the crystallization process of the quenched polyamides. With an increase in the degree of crystallinity, the ultimate forced elasticity increases, and ultimate elongation decreases.

Infra-red studies of polyvinyl alcohol by deuteration of its hydroxyl groups. H. Tadokoro. Bull. Chem. Soc. Japan 32, 1252-57 (Nov. 1959). Infrared spectroscopic measurements of deuterated polyvinyl alcohol (PVA) were made to study the crystallization-sensitive band at 1141 $cm.^{-1}$, to assign bands in the 1500 to 800 $cm.^{-1}$ region, to attempt to determine the crystallinity of PVA by the deuterium exchange method, and to examine the fine structure of the OH-stretching bands of the spectrum arising from the crystalline region. The differences between the velocity of deuterium exchange is negligibly small in PVA. Tentative assignments are given to the main bands in the 1500 to 700 $cm.^{-1}$ region.

Polyester's corrosion resistance profiled. Chem. Eng. News 38, 74 (Feb. 15, 1960). The results of 5-year tests to determine the chemical resistance of reinforced polyester plastics indicate good resistance to sulfuric acid up to 50% concentration, other inorganic acids, alkalies, acetic acid, formaldehyde, acetone, methanol, benzene and water.

Electrical properties of epoxy resins during polymerization. J. Delmonte. J. Appl. Polymer Sci. 2, 108-13 (July-Aug. 1959). Variations in electrical properties of epoxies during polymerization permit interpretation of molecular changes occurring. Three liquid epoxy resins selected for test were of different molecular weights. Curing agents selected included triethylene tetramine, *m*-phenylenediamine, and phthalic anhydride. Test specimens were cast between glass plates containing thin foil electrodes which permitted observations of electrical properties during cure. Test results disclose that for each of the resin systems, dissipation factors fell sharply as cure commenced and then at the onset of gelation, values rose again to a peak value.

Testing

New color reaction for methacrylate monomer and polymer identification. E. B. Mano. Anal. Chem. 32, 291 (Feb. 1960). Methacrylate monomers and polymers give a blue color on reacting with zinc and nitric acid, differentiating them from acrylics which do not give the blue color.

Determination of the occluded calcium hydroxyapatite in polystyrene beads. G. Mino and C. M. Judson. J. Appl. Polymer Sci. 2, 203-04 (Sept.-Oct. 1959). To determine the concentration of calcium hydroxyapatite occluded in polystyrene beads, styrene was polymerized in aqueous dispersion in the presence of calcium hydroxyapatite labeled with P^{32}. The large beads contain a larger concentration of occluded apatite than the smaller ones. The results suggest that larger beads are formed during the "sticky stage" by coalescence of smaller ones carrying apatite imbedded in their surface.

Film strengths in heat processing. E. G. Davis, M. Karel, and B. E. Proctor. Modern Packaging 33, 135-7, 208, 211 (Dec. 1959). A simplified apparatus is described for evaluating the burst strength of plastics films used in packaging heat-processed foods. Data are presented for high-density polyethylene, polypropylene, and polyester films. The technique is useful for determining optimum heat-sealing conditions, the effects of heat-processing, and the strengths of completed packages at the processing temperature.

Some special test methods applicable to polyethylene. D. Weston. Plastics (London) 24, 465-68 (Nov. 1959). Descriptions are given of pertinent changes in standard methods to measure more accurately the properties of PE. Data are given for four grades of PE to show the variations that may occur in routine testing and the necessity for selection of the proper test method for complete evaluation of the materials.

A field method for determining moisture in nylon molding powder. Steam-volumetric method. N. K. J. Symons and E. C. McKannan. Anal. Chem. 31, 1990-92 (Dec. 1959). A method for field determination of moisture is devised and applied to nylon molding powder. The sample is heated to 200° C. or above and the steam liberated is volumetrically measured. The (To page 176)

U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

U.S. Pats., Jan. 5, 1960

Expanded material. R. C. Steel (to Hexcel). 2,919,472.

Irradiated polyethylene. Q. P. Cole (to General Electric). 2,919,473-4.

Collagen-cyanoacetic acid composition. H. R. Hochstadt, E. R. Lieberman, T. L. Reissman, and J. Nichols (to Ethicon). 2,919,999.

Laminated sole. L. P. Frieder and W. S. Finken (to Gentex). 2,920,008.

Plasticizer. F. W. Banes, I. Kirschenbaum, and J. H. Bartlett (to Esso). 2,920,056.

Putty. J. E. Pritchard (to Phillips). 2,920,057.

U.S. Pats., Jan. 12, 1960

Plastic brush. H. Keller. 2,920,334.

Polyethylene film. J. R. White (to Du Pont). 2,920,349.

Polyethylene terephthalate film. M. Miller and D. R. McGregor (to Du Pont). 2,920,352.

Toy parts. P. W. Lindberg. 2,920,682.

Extrusion press. R. Genders (to Fielding & Platt). 2,920,760.

Reinforced structure. E. G. Dueringer (to A. O. Smith). 2,920,810.

Ski. R. T. Metcalfe and E. T. Chrobak. 2,920,898.

Cellular vinyl floor tile. B. F. Adams (to Armstrong Cork). 2,920,977.

Polyester fibers. D. I. Randall (to General Aniline). 2,920,978.

Polyurethane foam. J. Bugosh (to Du Pont). 2,920,983.

U.S. Pats., Jan. 19, 1960

Injection molding. J. C. Hendry. 2,921,341.

Sheet casting. W. K. Fischer (to U. S. Rubber). 2,921,346.

Color stabilized polyurethane foam. C. L. Wilson. 2,921,866.

Reinforced resin. F. B. Shaw (to Continental Can). 2,921,867.

Polyurethanes. F. Brochhagen, B. Koln, A. Hochtlen, and E. Weinbrenner (to Bayer and Mobay). 2,921,915.

Diisocyanate prepolymers. G. C. Harrison and H. C. Brinker (to 3M). 2,921,916.

Vinyl polymer stabilizers. S. H. Longman (to Carlisle Chemical). 2,921,917.

Polyethylene - polyalkylene oxide block copolymer. J. J. Smith and W. T. Reichle (to Union Carbide). 2,921,920.

Epoxidized polybutadienes. F. P. Greenspan and R. E. Light Jr. (to Food Machinery). 2,921,921.

Epoxy resins. P. Bruin, H. A. Dosterhof, and J. Selman (to Shell). 2,921,923.

Para - urazine - formaldehyde resin. V. T. Stannett and F. C. Shibel (to W. R. Grace). 2,921,924.

U.S. Pats., Jan. 26, 1960

Dip coating. E. F. Kempen (to Don-Ite). 2,922,725.

Flame-proofed nylon. L. J. Moretti and W. N. Nakajima (to American Cyanamid). 2,922,726.

Polyamide tire cord. R. Levison (to American Enka). 2,922,727.

Reinforced plastics. R. P. Hopkins and H. C. Young (to Rohm & Haas). 2,922,732.

Vinylidene polymers. G. Mino and S. Kaizerman. 2,922,768.

Vinylidene polymer. M. A. Coler and A. S. Louis. 2,922,770.

Polystyrene-polyamine. M. A. Coler and A. S. Louis. 2,922,771.

Molding composition. M. A. Coler and A. S. Louis. 2,922,772-3.

Stabilizing polyvinyl chloride. C. Wulff and M. Dohr (to Dehydag). 2,922,776.

Stable compositions. H. M. Rife and A. H. Walker (to Union Carbide). 2,922,778.

U.S. Pats., Feb. 2, 1960

Injection molding. J. R. Collion (to A. Nothelfer). 2,923,031.

Molding. H. H. Schwartz (to Empire Brushes). 2,923,035.

Optical measuring device for sheets. H. H. Allen (to British Celanese). 2,923,198.

Release coatings. A. D. Jordan Jr. (to Rohm & Haas). 2,923,646.

Metal-plastic films. J. V. Petriello. 2,923,651.

Photopolymerizable compounds. S. H. Munger (to Du Pont). 2,923,673.

Protein-urea aldehyde copolymer. H. H. Young and E. F. Christopher (to Swift). 2,923,691.

Carboxylic polymer. J. F. Ackerman and J. F. Jones (to B. F. Goodrich). 2,923,692.

Polyacrylonitrile. W. G. Schmidt (to Courtaulds). 2,923,694.

Epoxy resins. F. P. Greenspan and R. E. Light Jr. (to Food Machinery). 2,923,695.

U.S. Pats., Feb. 9, 1960

Polyethylene resins. S. Plonsky (to Celanese). 2,923,964.

Extrusion. A. L. Genouese (to National Plastic). 2,923,970.

Extrusion nozzle. S. C. Nelson (to American Viscose). 2,923,971.

Tube molding. B. Voumard and P. Monnier (to Voumard Machines). 2,923,975.

Injection molding. W. Strauss (to F. J. Stokes). 2,923,976.

Vacuum bag molding. L. H. Curzine (to Raymond De-Icer). 2,923,978.

Shell molding. T. G. Baker. 2,923,933.

Plastic shoe. R. Rosen. 2,924,029.

Flameproofing composition. J. E. Dereich (to Diamond Alkali). 2,924,-532.

Polyurethane foams. A. Bavley, C. J. Knuth, and A. E. Timreck (to Pfizer). 2,924,581.

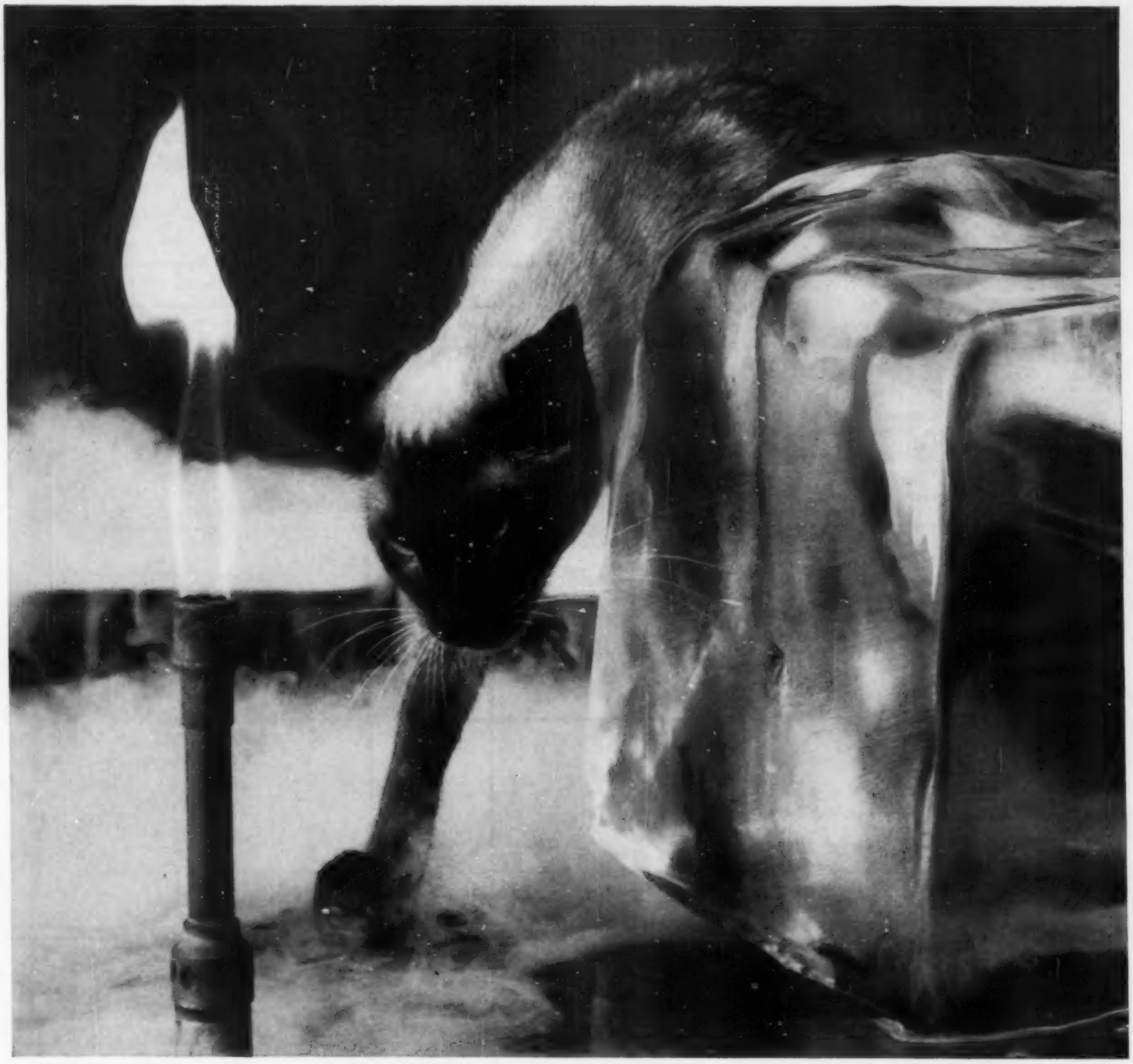
Vinyl chloride resins. D. H. Mullins, B. Phillips, and F. C. Frostick (to Union Carbide). 2,924,582-3.

Polyethylene. L. E. Wolinski (to Du Pont). 2,924,584.

Polyesters. J. V. Schmitz (to General Electric). 2,924,585.

Polycondensates. R. Lotz and G. Wick (to Glanzstoff). 2,924,586.

Polyisocyanates. L. M. Shorr (to Dow Corning). 2,924,587.—End



U. S. PLASTICS PRODUCTION

Production and sales figures in 1000 lb.* for the years 1958 and 1959. From statistics compiled by the U. S. Tariff Commission.

Materials	Preliminary Totals, 1958†		Preliminary Totals, 1959‡	
	Production	Sales	Production	Sales
Cellulose plastics:[a]				
Cellulose acetate and mixed ester:				
Sheet, under 0.003 gage	17,035	16,332	19,482	19,025
Sheet, 0.003 gage and over	18,420	17,743	22,581	20,630
All other sheets, rods, tubes (including other cellulose plastics)	9,071	8,487	9,052	9,506
Molding, extrusion materials (including other cellulose plastics)	90,839	88,428	103,993	100,463
Nitrocellulose sheets, rods, tubes	2,938	3,137	2,980	1,969
Other cellulose plastics[g]	3,056	2,209		
Phenolic and other tar-acid resins:				
Molding materials[a]	169,161	161,278	225,063	206,673
Bonding and adhesive resins for:				
Laminating (except plywood)	64,445	42,117	75,730	50,688
Coated and bonded abrasives	13,001	11,576	16,208	14,317
Friction materials (brake linings, clutch facings, etc.)	13,473	12,673	17,241	14,840
Thermal insulation	46,971	47,200	52,249	51,471
Plywood	51,411	43,386	61,251	49,964
All other bonding uses	41,367	40,446	63,551	61,529
Protective coating resins	28,736	24,221	28,726	22,658
Resins for all other uses	32,533	27,074	45,387	42,030
Urea and melamine resins:				
Textile-treating resins	34,169	32,184	33,542	32,110
Paper-treating resins	26,181	23,311	30,474	26,552
Bonding and adhesive resins for:				
Plywood	99,324	99,741	113,329	110,617
All other bonding and adhesive uses including laminating	43,395	39,266	60,858	48,193
Protective-coating resins	31,833	25,124	37,981	27,903
Resins for all other uses, including molding	90,510	88,344	124,704	118,941
Styrene resins:				
Molding materials[a]	442,211	449,647	644,816	561,834
Protective-coating resins	95,532	90,607	80,668	71,480
Resins for all other uses	157,761	125,425	207,062	228,950
Vinyl resins, total[b]	**820,023**	**800,223**	**1,151,897**	**1,076,174**
Polyvinyl chloride and copolymer resins (50% or more Polyvinyl chloride) for:				
Film (resin content)		72,404		86,232
Sheeting (resin content)		67,594		126,039
Molding and extrusion (resin content)		214,701		304,802
Textile and paper treating and coating (resin content)		63,050		64,691
Flooring (resin content)		113,584		151,838
Protective coatings (resin content)		28,921		31,427
All other uses (resin content)		69,094		94,419
All other vinyl resins for:				
Adhesives (resin content)		48,072		58,184
All other uses (resin content)		122,801		158,542
Coumarone-indene and petroleum polymer resins	**236,835**	**234,931**	**259,824**	**258,702**
Polyester resins:				
For reinforced plastics	98,099	89,021	130,425	116,563
For all other uses	15,764	13,315	22,027	20,668
Polyethylene resins total:	**865,306**	836,429	**1,203,639**	1,114,978
For film		317,784		345,033
Molding materials				212,544
Extrusion materials				154,175
All other uses		518,564		403,226
Miscellaneous:[a,d,e,f]	**211,461**	**183,047**	**300,147**	**303,012**

*Dry basis designated unless otherwise specified. †Revised. ‡Partially estimated. [a]Includes fillers, plasticizers and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c]Includes data for spreader and calendering-type resins. [d]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f]Includes data for acrylic rosin modifications, nylon silicone, and other plastics and resins for miscellaneous uses. [g]This classification discontinued in May 1958 and this material, mostly ethyl cellulose, reported in sheets and molding material.

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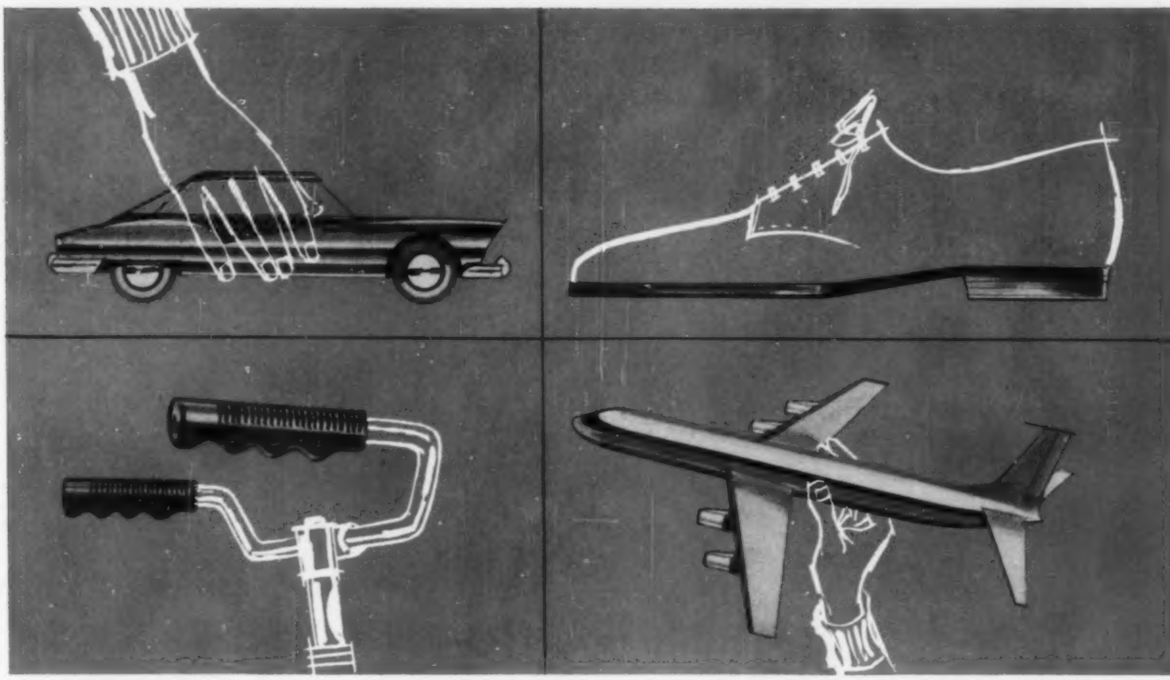

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VC-90	1.90
VC-95	2.02
VC-98	2.12
VC-100	2.25
VC-105	2.41
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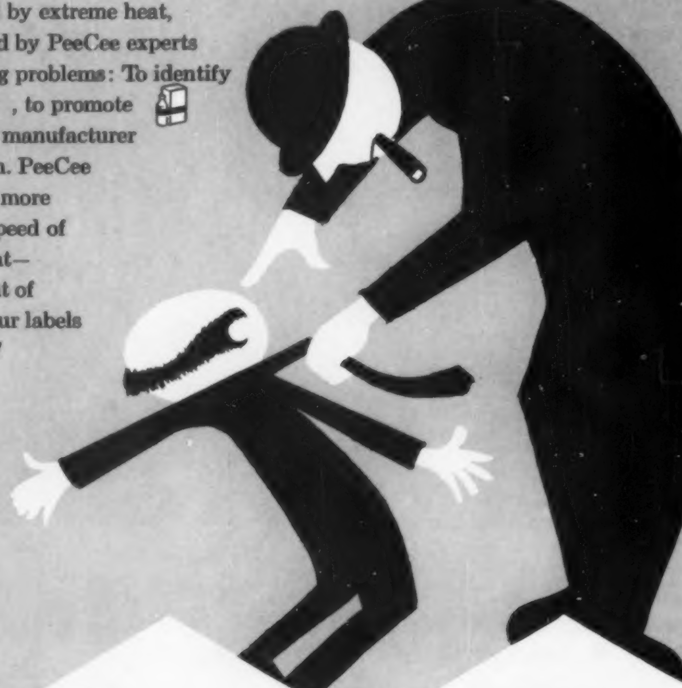

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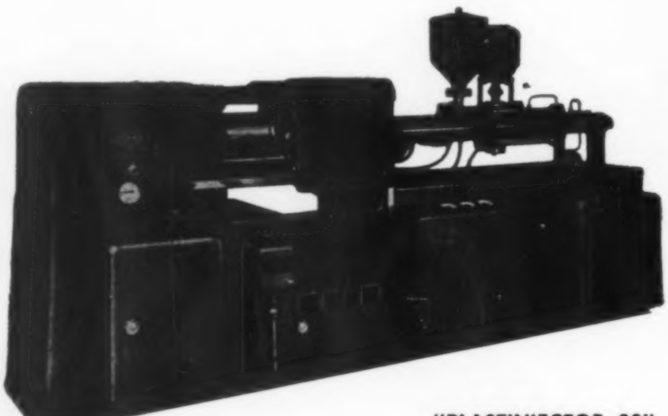

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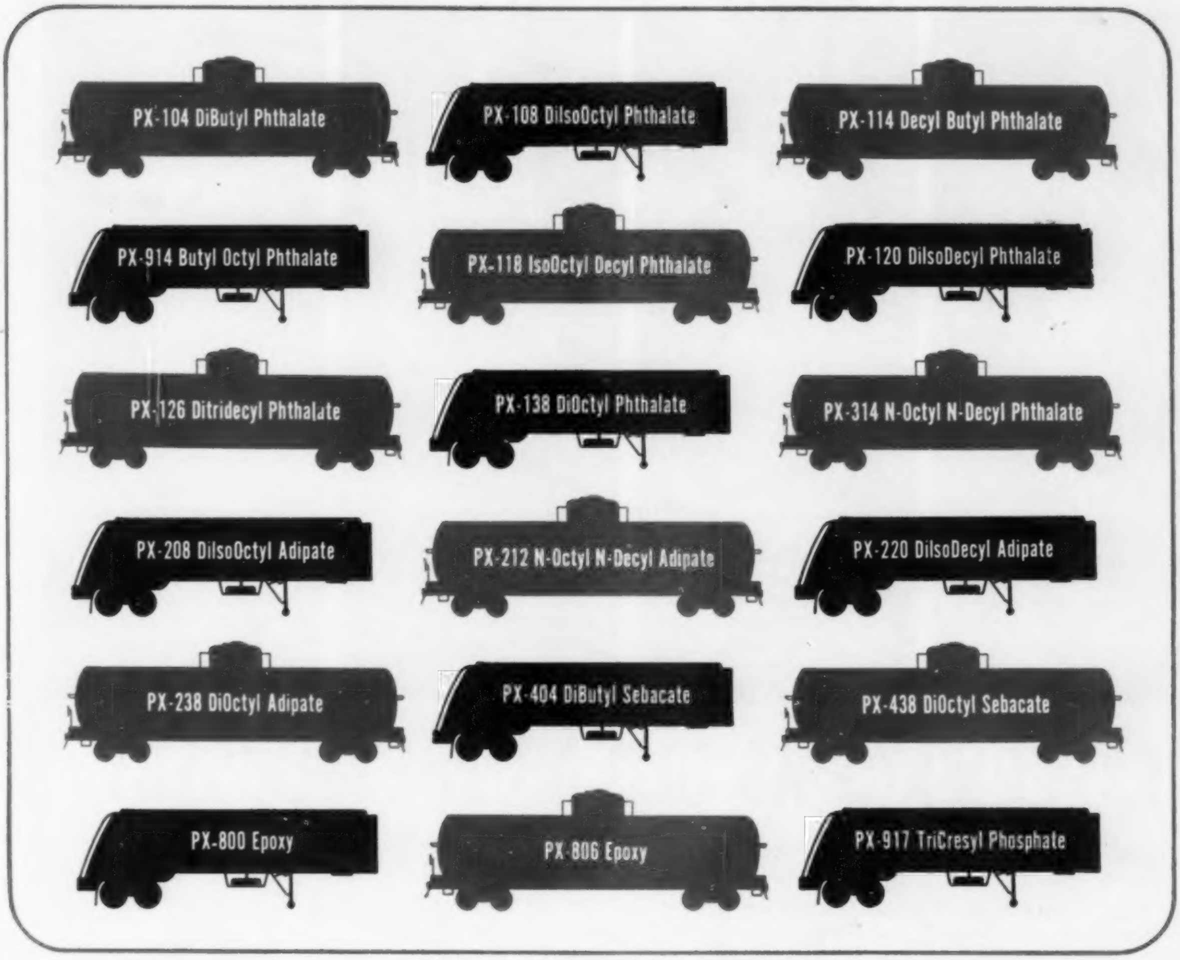
PX-104 DiButyl Phthalate
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PX-120 DiIsoDecyl Phthalate
PX-126 Ditridecyl Phthalate
PX-138 DiOctyl Phthalate
PX-314 N-Octyl N-Decyl Phthalate
PX-208 DiIsoOctyl Adipate
PX-212 N-Octyl N-Decyl Adipate
PX-220 DiIsoDecyl Adipate
PX-238 DiOctyl Adipate
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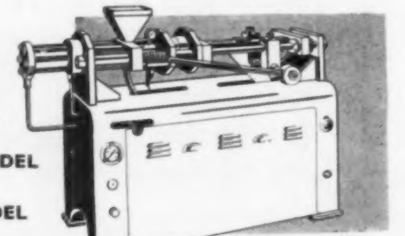

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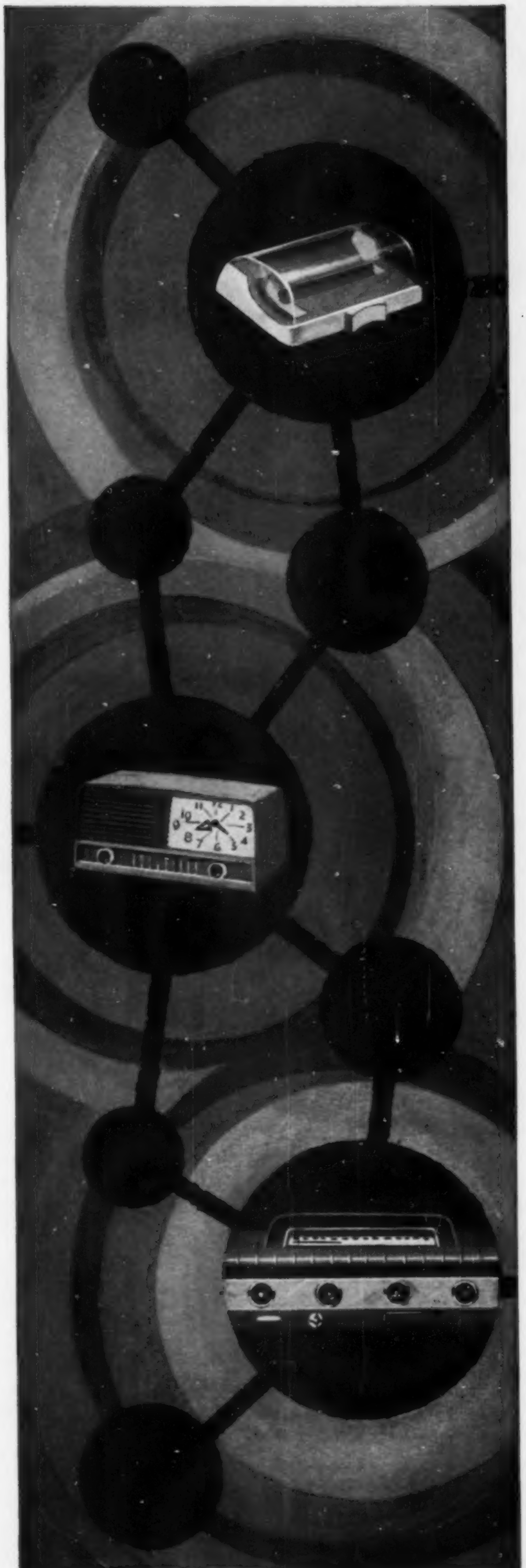

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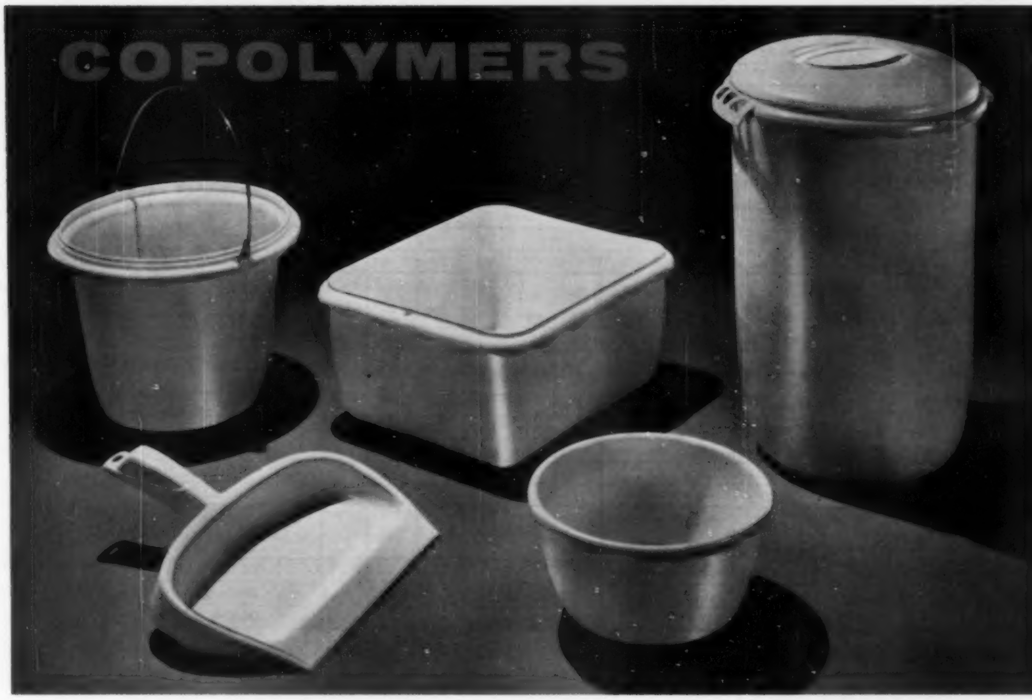
May 1960, Volume 37, Number 9

MODERN PLASTICS

New frontier for booming polyethylene—



HOUSEWARES ITEMS are injection molded from ethylene-ester copolymer material for improved rigidity, flex life, and stress crack resistance over conventional polyethylene housewares molding resins. The products, manufactured by Blisscraft of Hollywood, Gardena, Calif., include (from left) a bucket, dustpan, dishpan, bowl, and diaper hamper.

"Tailor-made" resins, now being formulated for a wide range of processing techniques, have broadened the market base of olefins. But you must know about melt index and density to get the most out of them

The dream of processors and end users for tailor-made resins has been taking some giant steps forward during the past year with the development of a whole new range of olefin copolymers. These materials, all offering one or more properties that can be truthfully rated as excellent, while retaining a high degree or balance of other desirable properties, are opening many a profitable market previously closed to polyethylene. They have solved such major problems as environmental and thermal stress cracking, low temperature brittleness, and processing difficulty. And, what's most attractive, they are generally no more costly than the

COMMERCIAL COPOLYMERS
and what they are used for

MANUFACTURER	Density	Melt index	Injection molding	General extrusion	Blow molding	Film extrusion	Pipe extrusion	Wire & cable covering	Monofilaments	Thermoforming sheet	Trade designation
Celanese Corp. of America											**Fortiflex**
	0.95	0.2		●	●			●	●		B50-20
	0.95	0.5		●			●				B50-50
	0.95	0.8	●								B50-80
	0.95	2.5	●								B50-250
	0.95	5.0	●			●					B50-500
W. R. Grace & Co.											**Grex**
	0.95	0.4		●	●			●	●	●	50-004C
	0.95	2.0	●								50-020C[a]
	0.95	3.5	●								50-035C
	0.95	5.0	●			●					50-050C[a]
	0.95	9.0	●			●					50-090C
	0.94	4.0				●					2001
	0.932					●					2201
Phillips Chemical Co.											**Marlex**
	0.95	0.3		●	●		●	●	●	●	5003
	0.95	0.5		●			●				5005
	0.95	1.2	●								5012
	0.95	4.0	●								5040
	0.95	6.5	●			●					5065
	0.94	0.2				●					TR-101
	0.95	0.3						●			TR-201
	0.95	0.5						●			TR-202
	0.96	0.3					●				TR-212
Union Carbide Plastics Co.											**Bakelite**
	0.935	8.0	●								DPD-7365
	0.935	8.0	●								DPD-7366[b]
	0.945	8.0	●								DPD-7070
	0.947	0.25			●						DMDB-3005

[a]—Available in flame retardant compound. [b]—Compounded with anti-static agent.

standard material. In those instances where the per-pound price is higher for the copolymer, economies in processing as well as the service life of the product far outweigh any such increase in cost.

There are two important factors that have to be kept in mind when talking about copolymers: density and melt index. These two factors to a large extent determine the processing conditions for a given material and the properties of the finished product.

Density describes how tightly the molecules are packed in a resin. The higher the density the more closely spaced the molecules are. In any ethylene copolymer, the addition of the second monomer in effect makes the material looser. On the one hand this causes a slight drop in mechanical and thermal properties, but on the other, it improves processability and resistance to stress cracking.

Melt index measures the ease with which the material will flow in the machine. Resins are available with various melt indices for any given density. While ease of flow is an important consideration in deciding on processing conditions, it also affects properties, and a balance must be struck, depending on the use.

By studying the chart on p. 88 it will be seen that a decrease in copolymer melt index increases the values for stress crack resistance, Izod impact strength, tensile strength, hot melt strength, and elongation, and lowers the rate of creep. On the other hand, an increase of M.I. results in better processing characteristics.

The past year has seen the commercial appearance of Phillips-type ethylene-butylene

resins in a wide range of melt indices, each tailored for specific end uses. Included in the group are: the Marlex 5000 Series of Phillips Chemical Co.; the Fortiflex B50 Series of Celanese Plastics Co.; and the Grex 50 resins of Polymer Chemicals Div., W. R. Grace & Co.

Processing of these resins, in comparison to the higher-density Phillips-type polyethylenes, is said by material suppliers to be quite good, particularly in the high melt index grades. The material can be injection molded, extruded, blow molded, and thermoformed by conventional techniques and equipment.

It is generally assumed that lower processing temperatures and faster cooling times are possible with the copolymers. This is true in the higher melt indices since the butene-1 monomer acts much like a plasticizer in the resin formulation. But at melt indices around 0.4 and below, where the "plasticizing" action of the butene-1 is not as effective, processing temperatures somewhat higher than those for straight Phillips-type PE are required.

Where they are used

The copolymers find application in those areas in which the 0.96-density Phillips-type polymer, principally because of property deficiencies, cannot compete. Once the desired properties for the application have been determined, selection of the right copolymer material for the job is a matter of choosing an M.I. type incorporating best balance of these properties.

Ethylene-butylene copolymer resins in the lower melt indices, from about 0.2 to 0.5 M.I., are primarily extrusion grade materials which have the highest values for environmental stress crack resistance and long-term load bearing ability. For example, stress crack resistance of copolymer resins in this range runs as high as 2000 hr., or roughly 10 to 20 times better than equivalent melt index straight polymer. For this reason, the materials are recommended for blow molded detergent containers, wire coating, and low-pressure pipe and tubing. Blown tubing, sheet and monofilaments are also produced from these resins; the monofilaments take advantage of the copolymer's high resistance to creep under static load and resistance to abrasion.

Materials with melt indices of around 0.5 are not normally suggested for the blown detergent bottles or filaments, but can be utilized in applications such as industrial moldings and wire coating, where easier processing is more desirable than maximum performance.

In the melt index range from about 1.0 to 5.0 injection molding applications enter the picture. Within the lower melt indices of this range it is possible to obtain a balance of good stress crack resistance with good moldability, thus making such resins suitable for metal insert molding. Higher melt index compounds within this range exhibit excellent flow properties, and are generally used for molding toys and housewares. Above 5.0 M.I., the copolymers offer maximum flow for molding of large, complex products and for water quench extrusion of soft, high-clarity packaging film. It is also possible to use these high M.I. materials for the injection molding of thin-wall, disposable containers, where impact strength is not the goal.

Copolymer resins tailored for extrusion of heavy-duty film are usually of 0.93 or 0.94 density, with melt indices from 0.2 to 4.0, and are

VENTED CAR SEAT of ethylene-butylene copolymer material is designed for long service under heavy stress and strain. The car seat is injection molded by Commonwealth Plastics Corp., Leominster, Mass., especially for Dennison Products, Newark, N. J.

specially compounded for toughness, clarity, and low gel count of product. Comparison of 5-mil industrial grade copolymer film with 10-mil Phillips-type 0.96-density PE film shows higher values for the former in tensile, burst, and tear strength, higher elasticity and elongation, and lower rate of water vapor transmission. Closer processing control and secondary operations on the part of the material supplier result in a slightly higher price for the copolymer film resins, generally 38¢ to 46¢/lb. depending upon color desired. However, as an example of realizable economy, bulk commodity bags made of 7-mil copolymer film compete successfully with 10-mil low-density PE bags, allowing higher bag production rates, less sealing time, and, according to one raw material supplier, resin savings of 30% or more.

Ethylene-butylene resins for pipe extrusion are of low melt index type to ensure good resistance to environmental and thermal stress cracking and to gain good load bearing qualities. Like the film resins, they are more costly, due in part to the addition of carbon black dispersion and antioxidant. Pipe applications are in the transmission of cold water, brine, and natural gas, under temperature conditions not exceeding 90 to 100° F.

There are also specially-compounded resins for wire and cable covering, with 0.95 densities and melt indices of 0.3 and 0.5. They cost between 38¢ and 44¢/lb., depending on color. Finally, one supplier offers 2.0 and 5.0 M.I. copolymers that are compounded for flame retardance. This is accomplished by the addition of chlorinated paraffins, thus prices are again higher—from 50¢ to 52¢ per pound.

Price of the copolymers of ethylene and butene-1 depend upon melt index, with the price break occurring around 2.0 M.I. The lower melt index materials are somewhat more difficult to synthesize and are priced at 38¢/lb. for carload lots, while the higher melt index resins cost 35¢ per pound. This price picture is standard for all ethylene-butylene copolymers except the specially-compounded resins.

Copolymer markets

Perhaps the greatest market for copolymers of ethylene and butylene is in blow molded containers for light duty liquid detergents. It is not known exactly what the copolymers' share of this market will be this year but low-pressure PE consumption for blown detergent bottles is estimated at 20 million pounds. Looking to the future, one major supplier of copolymer material for bottle blowing is optimistically eyeing the liquid bleach market, which retailed in the neighborhood of 600 million quart units in 1958. Manufacturers of industrial carboys, 5 gal. and up, are reportedly studying olefin copolymers for their products; this is a growing market, with yearly unit sales now believed to be in the tens of thousands. Olefin copolymer materials for heavy-duty film bags, to compete with more expensive multiwall bags, are expected by material suppliers to grab off a good share of the bulk commodity packaging market. Estimates of the market for *all* PE packaging film stand at over 200 million lb. for 1959.

Other applications proposed by copolymer suppliers are: coilable pipe below 2 in. in diameter; molded or thermoformed tote boxes; thermoformed liners welded by hot air directly inside large industrial tanks; chair seats, injection molded around bolt inserts; and utility products for food processing and hospital applications that can be sterilized up to 250° F.

Another formulation

Three olefin copolymers introduced during the past year by Union Carbide Plastics Co. are produced by the reaction of ethylene with an ester believed to be (although never identified by Union Carbide), ethylacrylate. They are primarily designed for the injection molding of

What melt index does to properties

Lower melt index generally means:

1. Better stress crack resistance
2. Higher impact strength
3. Lower creep
4. Better hot melt strength
5. Slightly higher tensile strength
6. Greater elongation

Higher melt index generally means:

1. Better flow characteristics
2. Improved surface gloss
3. Slightly less warpage
4. Lower processing temperatures (around 0.4 melt index and above)

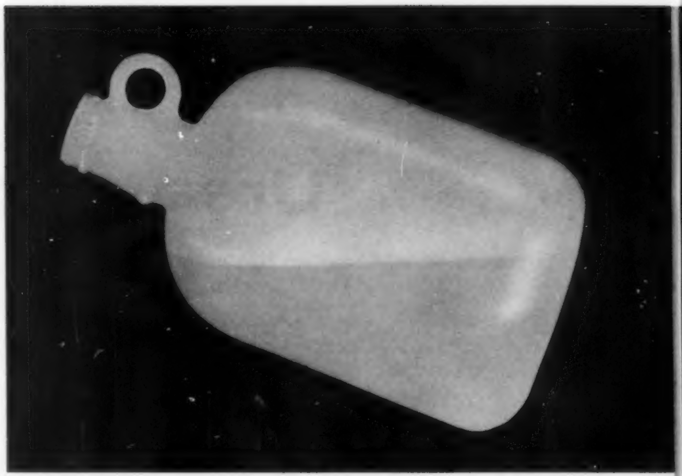
housewares, such as dishpans, outdoor garbage cans, laundry baskets, bowls, buckets, and baby baths. Two of these houseware molding grade resins have similar densities of 0.935 and melt indices of 8.0, and are said to have good toughness at temperatures as low as −22° F., a practical stress crack resistance of around 335 hr., and a flex life similar to a lower melt index resin. Because of this good flex life, the resins are suggested by the producer for the molding of self-hinged parts, such as tool boxes, toy kits, and fishing tackle boxes. The only difference between these two copolymer materials is the addition to one of an antistatic compound to eliminate polyethylene's tendency to attract dust. The exact nature of this additive has not been revealed, but UC tests have demonstrated that any powder-like material, brought into close proximity will not be attracted to an article molded from this resin. The other houseware molding material has a density of 0.945 and a melt index of 8.0, an attractive combination for rigidity plus toughness.

Another compound is designed for blow molding. It is a material with slightly lower density (0.947) than UC's straight high-density PE, but with over 500 hr. of stress crack resistance as compared to around 100 hr. for high-density material. This copolymer is also said to offer characteristics of stiffness, corrosion resistance, toughness, and permeability that are almost comparable to the high-density materials. Despite a 0.25 melt index, the blow molding resin has a higher flow rate than straight high-density PE; it flows more freely in conventional plasticating equipment, permitting lower operating temperatures and leading to faster cycles and lower costs.

Ethylene and propylene

The plastics materials market has also been entered this past year by copolymers of ethylene and propylene. Both monomers are plentiful and inexpensive, and the copolymers will certainly bear watching. Montecatini has copolymerized these materials into a synthetic elastomer which is being evaluated for truck tires. Hercules Powder Co. has produced a similar elastomeric material which is currently undergoing early field testing for possible use in the rubber industry.

The Montecatini material is said to possess great resistance to oxidation, heat, and aging because of its saturated structure and chemically inert nature. The mechanical properties are said to be intermediate between those of natural rubber and styrene-butadiene copolymers, and the material can be processed on standard equipment and by standard techniques. One exceptional and significant feature of the material is its low density—0.85 to 0.86.



HALF-GALLON CONTAINER is blow molded from ethylene-butylene copolymer material, which resists corrosive action of acid and alkali liquid products. Container, featuring integral finger grip for ease of pouring and carrying, is manufactured by Vantines Inc., Flushing, N. Y.

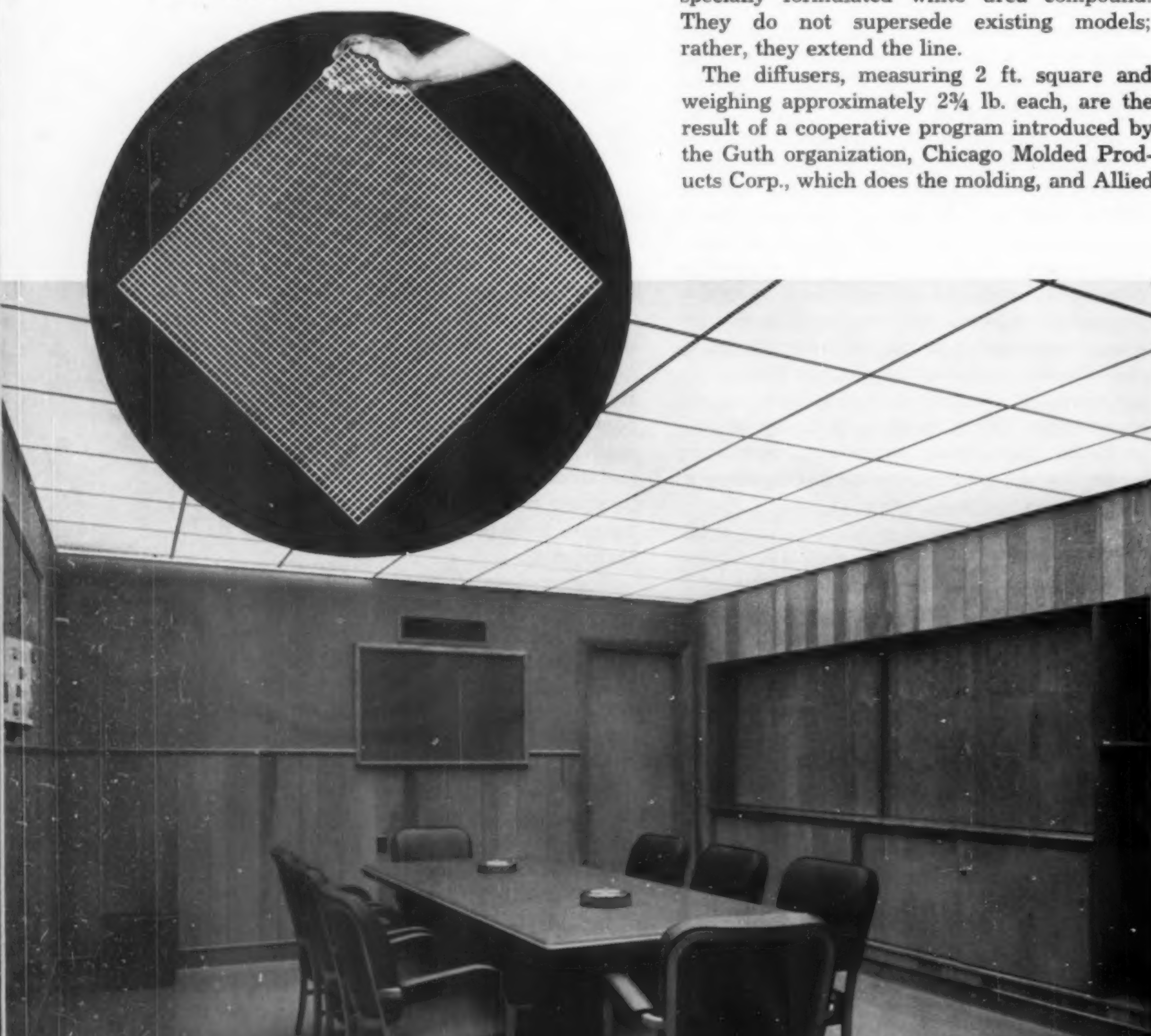
Olefin producers who employ the Ziegler method of formulating high-density PE have not been as active in copolymers as the firms that use the Phillips formulating method. One theory states that since the Ziegler product is not as dense as the Phillips-type resin—because of the different catalyst system used—the drawbacks associated with higher density and linearity are not critical, and the copolymerization route has, therefore, not been as actively pursued. By the same token, the producers of low- and intermediate-density polyethylene by high-pressure methods have little to worry about, because their products have practically no linearity at all.

Nevertheless, developmental work on Ziegler-type olefin copolymers is known to be underway at Hercules, Koppers, and Dow, and others will undoubtedly join the ranks. Du Pont is not only field-testing a high-flow molding resin copolymerized by the high-pressure process, but also lab-testing a 0.93-density ethylene copolymer for molding and film extrusion, and a 0.94-density ethylene copolymer for wire and cable coating, both produced by the low-pressure method.

It seems safe to say that the existing olefin copolymers will be further improved and refined, will go up in quality and, in many cases, down in price, and will enter many new and profitable markets.—**End**

Urea light shields meet

EVEN ILLUMINATION in conference room is provided by ceiling of light composed of molded urea louvre gratings which are suspended from special ceiling fixture. Gratings diffuse light through more than 3000 openings. Inset (below) shows close-up of one panel.



In order to meet revised fire code ordinances in various metropolitan areas that specify use of a self-extinguishing material in light shields and diffusers, Edwin F. Guth Co., St. Louis, Mo., has turned to thermosets as a solution to this problem. The company has long been a producer of thermoplastic grate-type light diffusers sold under the tradename Gratelite. The new diffusers, similar in design to the thermoplastic models, are compression molded of a specially formulated white urea compound. They do not supersede existing models; rather, they extend the line.

The diffusers, measuring 2 ft. square and weighing approximately 2¾ lb. each, are the result of a cooperative program introduced by the Guth organization, Chicago Molded Products Corp., which does the molding, and Allied

fire code

By going to compression molded amino resins, maker of light diffusers extends his line to comply with fire regulations—at competitive prices

Chemical Corp., which is the supplier of the Plaskon urea material.

Like its thermoplastic counterpart, which is injection molded of styrene, the new Guth N-C (non-combustible) Gratelite is mounted in multiples in a specially designed ceiling suspension system beneath the light source. The more than 3000 openings in a panel, each ⅜-in. sq., create a cellular-type shield, permitting light to pass through while screening the direct source of illumination and eliminating glare. The result is a diffused, virtually shadow-free light, particularly desirable for drafting rooms and other locations in which exacting visual work is performed. In an installation for a 16- by 20-ft. room, approximately 225 lb. of molded translucent white urea is involved.

Under Guth's exacting requirements for this lighting component, the louvres must be molded of non-combustible thermosetting materials having a UL tunnel-test flame rating not to exceed 25. They must also be non-toxic, non-static, absolutely rigid, and must incorporate a built-in ultraviolet retarder to provide color stability within IES standards. The louvre must be molded from dimensionally stable, scratch-resistant materials and meet Underwriters' approval for use beneath sprinklers. Louvre vanes, on ⅜-in. centers and ⅜-in. deep, are designed to provide 45- by 45-degree shielding.

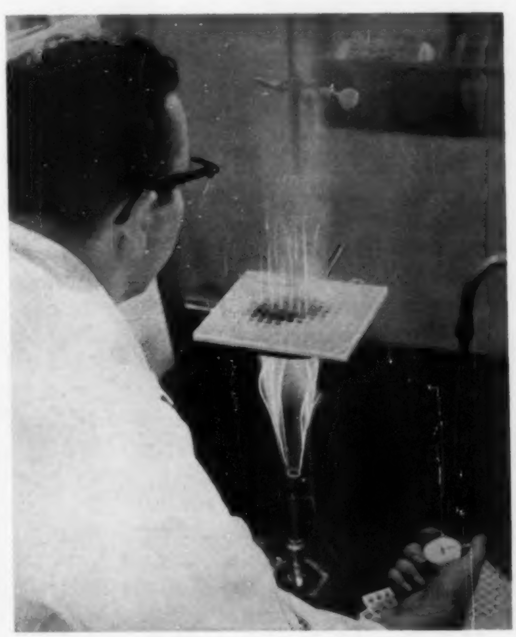
How they are molded

The new N-C Gratelite is produced in a 1500-ton compression press, using a single cavity mold and electronically heated preforms. The material used is Plaskon UFR F-28, which was approved in UL Test 723, giving a flame spread rating of 25. This is said to be the only molded plastic part ever to pass this test. The mold had to be so constructed that there was absolutely no flex across the entire surface during the compression and cure cycle. Also, knock-outs had to be correctly placed so that in removing the part from the mold, a mechanical warp would not be initiated before the part could be placed on cooling fixtures.

Electronically heated preforms were used so that the flow would tend to equalize itself across the entire surface of the mold, producing an equally dense section in each of the hundreds of openings.

Due to the waffle-like design of the louvre, all the openings are covered with a very thin web of flash at the parting line when it is removed from the mold. This flash is mechanically removed before shipment. To protect them against possible damage during shipment, a corrugated pad is placed between each two parts.

Guth's new N-C Gratelite louvre diffuser is of particular interest in view of the increasing emphasis placed on flame resistance and self-extinguishing characteristics by Underwriters' Laboratories and various other agencies. It demonstrates that despite the preponderant use of thermoplastic materials in luminescent ceilings, fluorescent diffusers, and various other lighting applications, certain thermosetting materials—such as urea—may still have a bright future in the lighting field.—End



FLAME SPREAD of section of urea louvre is checked by technician at molder's plant.

THE PLASTICS TYPEWRITER—
a big step forward!

Remington Rand, scooping the whole industry, goes all plastics on the housing of its latest portables. Lighter weight, better design potential, and merchandising benefits—at no cost premium—convinced them to switch from metal

What does it take for a major manufacturer of quality consumer goods to switch to plastics in a design area heretofore exclusively dominated by metal?

According to Remington Rand, Division of Sperry Rand Corp., whose ABS (acrylonitrile-butadiene-styrene) portable typewriter housing has turned out to be the application bombshell of the year, it takes a lot—a lot of intensive study, research, and evaluation; a lot of sound engineering specifically for plastics; and a lot of close cooperation between manufacturer, designer, material supplier, and molder.

But the results can pay off!

In this particular case, they paid off in the magnificent job illustrated on the facing page—probably one of the smartest looking and practical portables ever to hit the consumer market. And just think of the implications—the last major bastion of resistance in the office equipment field has finally fallen to the concept of the plastic housing (adding machines, photocopiers, and the like have long since been in the plastics fold). Not since the introduction of plastics radio cases has there been a consumer product with such potential for selling the concept of quality in plastics to the general public.

A close look at the two-year development period preceding the introduction of the 1960 Quiet-riter Eleven points up some interesting aspects of successful product design.

Picking the plastics

Remington Rand design engineers are by no means strangers to plastics. Styrene housings are already in use for the company's line of adding machines, typewriter keys are generally molded of modified acrylic, and there are any number of component parts molded either of thermoplastics or thermosets which have been used in the past. Nor is the idea of a plastic typewriter housing new. Several companies have tried it on an experimental basis over the years—but with little success.

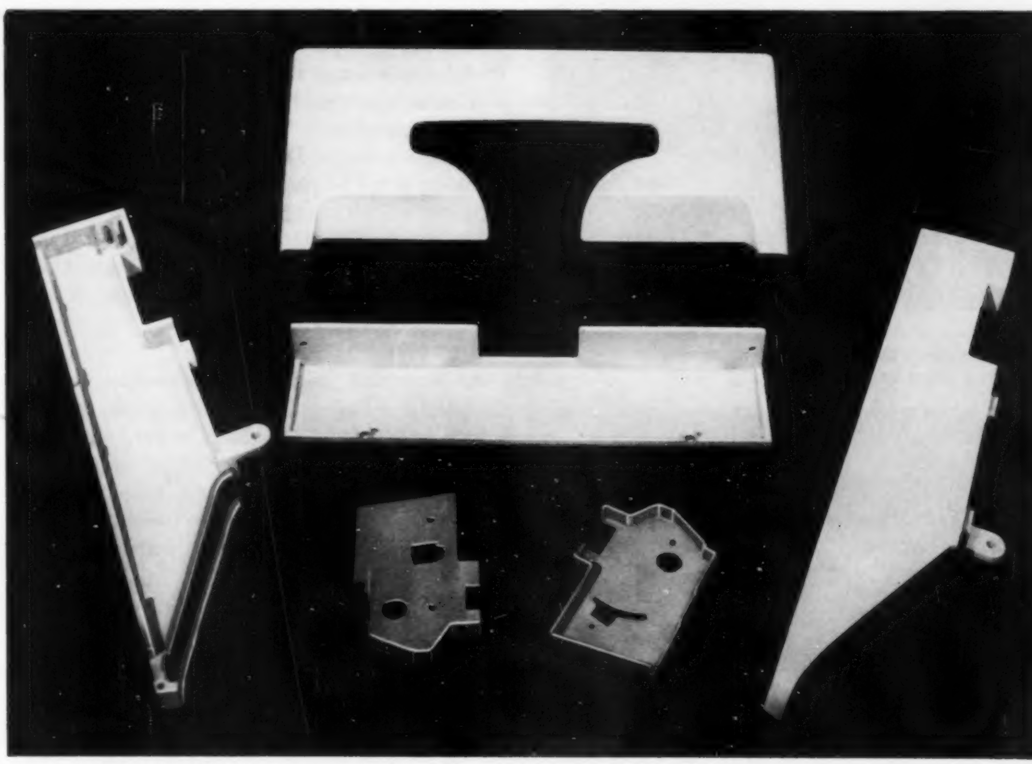
As far as Remington Rand is concerned, the present plastic housing had its beginning back in 1958 when the company started to make plans for the current new model portables. In conjunction with the industrial designing firm of Sundberg-Ferar Inc., Detroit, Mich., the company developed a smart looking two-tone portable that featured graceful, unbroken lines, a low silhouette, an overhang in the front of the typewriter (with relatively thick cross-section) that sold the solid construction of the machine, and a smooth finish (the crinkle finish which has been a standard design feature on typewriters for a number of years offers a very limited visual appeal and has a proven disadvantage as a dust gatherer).

Two forms of metal came up for initial consideration: sheet and die casting. The sheet metal would, of course, be much less costly than the casting, but there was the problem of its denting in service; its design potential was limited as far as sharp, unbroken lines were concerned; and it would have been impossible to create the overhang without beading the edge of the metal and destroying the over-all styling. The die casting, on the other hand, would fit in with styling requirements, but the thick wall sections would add to the weight of the product and hand finishing would be necessary to smooth out the surface, thereby complicating the finishing process. With the use of both metals, of course, an extensive finishing line would have to be set up.

It was at this point that plastics entered the

Photo, Consolidated Molded Products Corp.; 4-color plates, Marbon Chemical

SUAL IMPACT OF PLASTIC-HOUSED portable (entire casing is molded in six parts of ABS lymer) is heightened by smooth, glossy finish (metal casings have crinkle finishes) and rich loring (six colors are available). Name (left) is molded; model designation (right) hot-stamped.



Photo, Consolidated Molded Products Corp.

SIX ABS POLYMER PARTS include: top cover (top); the rear cover which fits on the back of the typewriter (center); two carriage end covers (foreground); and two side panels (left and right).

picture. The specifications to be met: "give us all the styling potential we could expect from a die casting, but without the weight or finishing that casting implies."

ABS polymer

Remington's design engineers, with the full cooperation of all the materials suppliers involved, then set out on an extensive plastics evaluation program that eventually led to a decision to use Marbon Chemical's Cycolac 15225-2 ABS polymer (a special formulation with increased heat resistance). The advantages of plastic over metal were apparent almost from the beginning.

The ABS material could be molded with a smooth, glossy surface, was scratch resistant, and would not wear away with use; it was pleasant to the touch and its integral color potential opened up whole new avenues of merchandising; its impact strength was high; its chemical resistance would leave it unharmed by ribbon inks, type cleaners, hectagraph inks, carbons, etc.; its dimensional stability met the requirements of "no more than 0.0010 in. change in width, 0.0020 in. change in length, and 0.0040 in. change in bow;" and its heat resistance met specifications of "down to —45° F. and up to 170° F.

Above all stood the important factor of design potential. Taking advantage of the material's moldability, it became obvious that the original design features could easily be met—with the modifications necessary to design any product *specifically for plastics.* Thick wall sections could be used without excessive weight penalty. (As it eventually turned out, wall sections went up to 0.150 in. thick, yet the total weight of plastics parts came to only 1 lb., 4½ oz.; metal parts on previous models added up to a 2 lb., 3½ oz. total. Design engineers also found opportunity to incorporate integral lugs and holes into the various plastics parts to facilitate assembly.

Based on these facts, Remington made the decision to go to plastics. The final problem to iron out was putting the production of the parts on an economical and practical basis. It was here that Consolidated Molded Products Corp., Scranton, Pa., entered the picture.

Photos, Consolidated Molded Products Corp.

TOP COVER—largest of the six parts—is molded in an individual single-cavity mold; a tab type of gate is used to avoid stress areas and blush marks.

Preliminary steps

At the initial meeting, it was decided to mold the plastic housing in six parts—right and left side panels, top cover, back cover, and right and left carriage and covers—that could easily be disassembled for servicing (see photo, p. 93). Preliminary designs were based on a wall thickness of 0.090 to 0.100 in., with ribbing on the underside. Concern was felt, however,

HOLES ARE DRILLED into the front face of the top cover to accommodate a molded name plate that will be inserted during a later assembly operation.

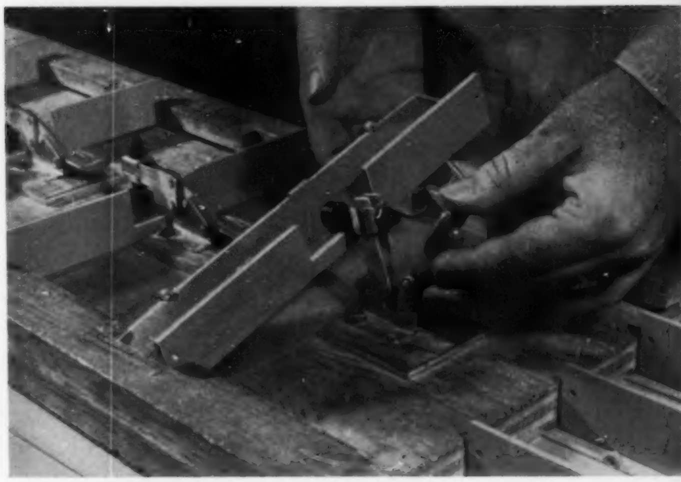
about the possibility of sink marks showing up or warping taking place because of the ribs. It was, therefore, decided to eliminate most of the ribs (stresses in the molded piece would thereby also be minimized) and use a wall thickness of 0.150 in. to provide adequate strength and rigidity.

At the second meeting, revised designs were discussed. One point under consideration was the heavy bosses that would be required for mounting. It was decided to mold these separately and cement them in place after molding. Slight recesses molded into the parts would provide for accurate location. Plans were also made for providing interlocking sections between the various plastics parts that would keep them in place during assembly. And finally, consideration was given to the treatment of the edges of the plastics parts where two surfaces mated. There was a choice of a deliberate overlap, a bead to conceal the joint, or slightly beveled edges. It was decided to use flush surfaces with the edges slightly beveled.

From test molds to finished pieces

With the basic design under their belts, Remington Rand and Consolidated—with Marbon sitting in—decided to test-mold one piece before going ahead with ordering production molds. The piece selected for the test was the side panel. Molds were made up (including the mounting bosses which were to be cemented into place). One immediate problem which showed up in mold making turned out to be a projecting rib that formed a narrow apron on either side of the keyboard when the panel was mounted to the frame. This rib was joined to the main part of the panel with a large sweeping radius. In order to avoid a large mass of material where the rib joined the main body, it was necessary to have a similar radius on the underside of the rib. Since the rib was molded in the direction of the draw, the radius on the underside of the rib constituted an undercut. It was, therefore, necessary to form one side of the rib and radius using a rising section of the mold. Although at first glance, this procedure seemed to be a round-about way to go to avoid a sink mark, it turned out to be the most logical solution other than having to do the less satisfactory job of cementing the rib in place on the face of the panel.

The mold also had several side cores operated by cams which were used to mold the mounting holes and interlocking slots that were at right angles to the draw. (To page 178)



NEED FOR PRECISION mating of parts called for use of warpage control fixtures; rear cover is here being removed from such a fixture.

SIDE APRONS on all side panels and the front recessed area of the top cover are sprayed with a dark grey color that provides a striking contrast to the six decorator colors in which the parts are molded.

WHY plastics for

Economy and long life in bearings are being brought by plastics to fields ranging from electric shavers to steel mills, from outboard motors to giant ocean liners, from typewriters to electronic computers, from lawn mowers to railroad cars. In contrast to metal for rotating and oscillating bearings—bronze, babbitt, and ferrous metals and their alloys—plastics offer freedom from corrosion, often eliminate the need for lubrication, reduce maintenance, and bring quiet operation.

Bearing materials must serve two basic and related functions: 1) they must reduce friction and 2) they must resist wear. At the same time they must have impact strength, resistance to cold flow (creep) under service pressures, and ability to withstand extremes of temperatures.

Because of their slipperiness (low coefficient of friction), several of the plastics can eliminate lubrication troubles in many bearing applications. In fact, some of the polymers—notably polytetrafluoroethylene (PTFE) and nylon—are themselves considered as solid lubricants.

The exception to self-lubrication in plastics bearings is phenolic laminate, which must be lubricated, except when used in applications where movement is limited. But its other properties are such that it has firmly established itself in many areas, for reasons pointed out later in this article.

There is another important contribution that plastics make: when particles of metals, sand, dust, and other contaminants work their way into a plastic bearing, they tend to become embedded in the plastic. Thus "protected" by the surrounding material, they cannot score either the bearing or the shaft.

For this reason alone, plastics bearings can continue to function under adverse operating conditions long after abrasion by contaminants would have ruined the ordinary metal bearings and shafts being used.

There is as yet no broad foundation of scientific knowledge on which to base precise predictions of results to be obtained with all plastics in specific bearing applications. However, sufficient practical work (see Table I, p. 181) has been successfully accomplished to indicate that plastics bearings are bringing important benefits to industrial users. The developments described in the following paragraphs and the uses listed in the tabulation on p. 99 give a selected view of what is being done at the present time; on this can be built a realistic estimate of other possibilities.

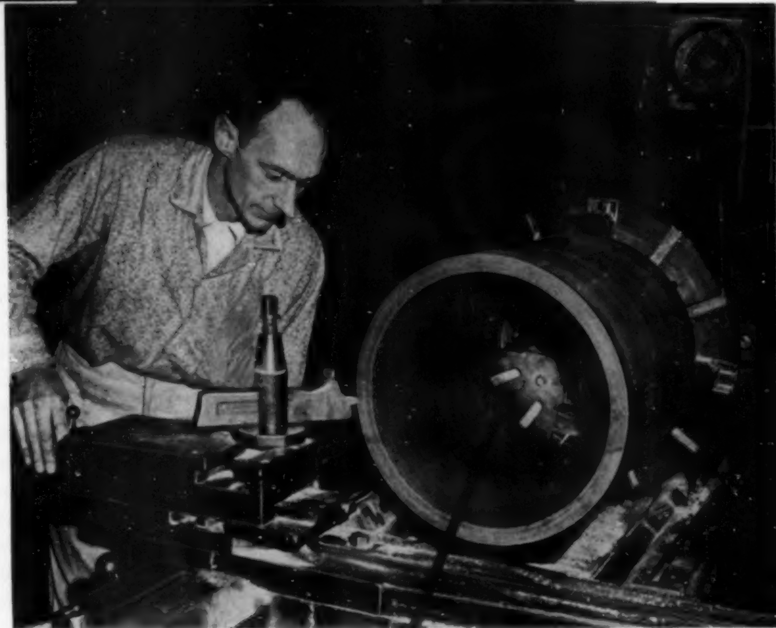
Phenolic laminates

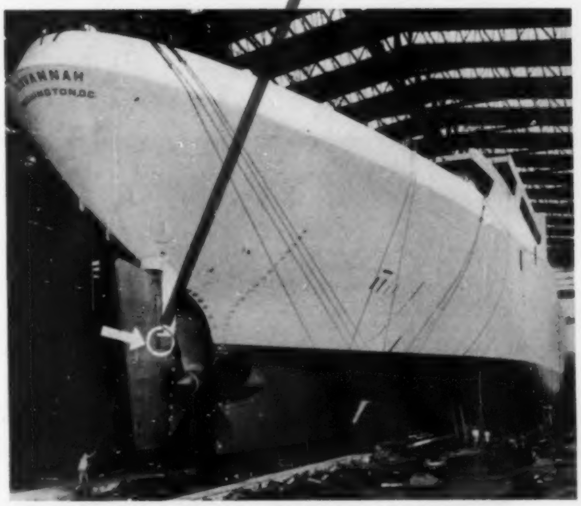
It is not surprising that phenolics are taking on the biggest and toughest jobs. Laminated with cotton fabric, and often with asbestos for special uses, these composite materials are giving excellent service in propeller and rudder shaft bearings in ships and in roll-neck bearings in steel mills. Such bearings may be fabricated

PHENOLIC LAMINATE retainers (arrow in photo at left) for precision ball bearings are made by The Barden Corp., Danbury, Conn., using Synthane laminated tubing. Such retainers are fabricated in various sizes and styles (photo above) and find wide industrial applications where their light weight and low starting torque, as well as smooth acceleration give economical service life at high speeds.

bearings

Freedom from corrosion, no need for lubrication, quieter operation, and reduced maintenance— these are the benefits plastics bring to bearing applications





NUCLEAR SHIP SAVANNAH has underwater rudder pintle bearing (circle in photo above) fabricated of Westinghouse Micarta phenolic laminate. Machined from tube-stock (see photo, upper right), the finished bearing weighs 60 pounds. It is 26½ in. long, and has an outside diameter of 16 inches.

from molded or rolled stock tubes, which can be machined readily by conventional shop methods, or molded to finished or semi-finished form from macerated-fabric-filled phenolic. They are lubricated by a constant and regulated flow of water.

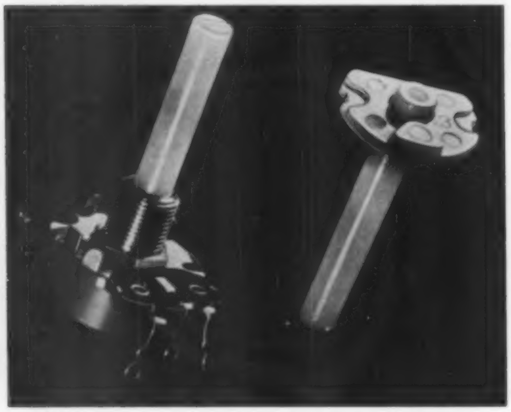
According to American Brake Shoe Co., New York, N. Y., phenolic propeller shaft bearings are rapidly replacing the classic lignum vitae wood bearings. Not only does the laminate outlast the wood many times, but also it has greater shock-absorbing capacity and is chemically resistant to oil, mild acids and alkalies, industrial wastes, and other forms of pollution found in rivers and harbors.

The ability to take severe shock loads without peening or taking a permanent set also makes phenolic laminates outstanding as a bearing material in steel and paper mills. Synthane Corp., Oaks, Pa., states they outlast metal bearings up to 20 times, save machine downtime, cut power and repair bills, and reduce machine noise. In addition, since water is a perfectly adequate lubricant, phenolic laminate bearings are finding uses in many types of pumps and in situations where grease or oil would contaminate the product. However, conventional oils and greases can be used when dictated by the mechanics of the application.

Heavy-duty applications are not the only fields for phenolic laminate bearings. The data on p. 99 summarize other areas which have been proved or are being explored.

Machined phenolic laminates are also competing with metals in ball-bearing retainers. Here their ease of machining to close tolerances, light weight (one-sixth that of steel), and low friction and wear against metal surfaces give them decided advantages. Starting torques are lower and more consistent. Acceleration is faster and smoother because galling (temporary sticking or binding between two metal surfaces) is eliminated. Lubrication troubles are reduced because the cotton fibers exposed during machining absorb a small quantity of lubricant and the bearings are virtually self-lubricating during start-up. Phenolic laminate ball-bearing retainers, according to Synthane reports, are now being used in textile ma-

AUTOMOBILE MANUFACTURERS, among others, are adopting compression molded laminate bearings produced by Russell Mfg. Co., using Du Pont's Teflon and cotton fibers, impregnated with a Union Carbide phenolic resin. Such bearings exhibit low coefficient of friction and cold flow, extreme durability, and excellent corrosion resistance.



NYLON can often be molded into parts which serve as their own bearings. For example, this TV focusing control has a major Zytel nylon component, produced by American Molded Products, Chicago, Ill., for Chicago Telephone Supply Co. The nylon is a good electrical insulator, resists twisting and impact stresses, and its low coefficient of friction provides smooth operation.

chinery bearings operating at 100,000 r.p.m.; highest speeds attainable with metal retainers are less than 70,000 r.p.m.

Polytetrafluoroethylene

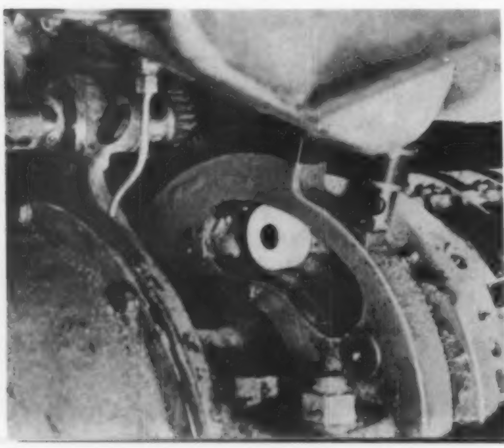
Of all the "newer" plastics, PTFE appears to offer the most fascinating possibilities (see "PTFE bearing materials," MPl, Feb. 1959, p. 123). It has an extremely low coefficient of friction, almost complete chemical inertness, and a wide temperature range. However, because of the tendency of the pure molded material to creep under pressure, its relatively high wear rate, and its high cost, it is generally modified for best results. Additions of glass fibers, graphite, and other fillers and reinforcements increase the coefficient of friction of PTFE only slightly, but can increase the PV[1] value and reduce creep and wear rate tremendously.

One compound of PTFE, modified with molybdenum disulfide and reinforced with glass micro-fibers by Rogers Corp., Rogers, Conn., is now reported to be in use in bearings in after-burners of one type of jet engine. These bearings operate without lubrication in an ambient temperature of 500° F. and are reported to have a PV value of 10,000 average, with higher values at the lower surface speeds. As with all PTFE compounds, low rate of heat dissipation is very important, and, in general, shaft speeds below 1000 r.p.m. are recommended.

Another reinforced PTFE for use in bearings is made available by General Plastics Corp., Paterson, N. J. It is reported to have excellent dimensional stability over a temperature range of —425 to 475° F. Presently supplied in tube form up to 6 in. long and 4½ in. O.D., these bearings are said to be machinable by conventional methods without distortion or flow. Preliminary tests show a PV value of 10,000 at high (to 1000 r.p.m.) shaft speeds, and up to 60,000 at low speeds.

The work of Dixon Corp., Bristol, R. I., with glass-reinforced and otherwise modified PTFE bearing materials, as well as that of U. S. Gas-

[1]PV=load in p.s.i. on projected bearing area times surface velocity of shaft in ft./minute. High values indicate good bearing characteristics.



CAM FOLLOWERS machined from nylon rod retain their precision on both bearing surfaces after months of use; followers of other materials require frequent replacement. Follower shown, used on folding section of printing press, was produced from Polypenco (The Polymer Corp. of Pa.) nylon stock.

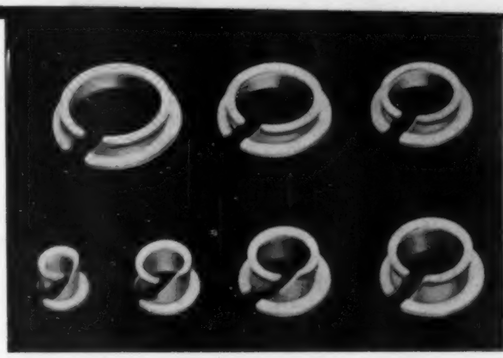
ket Co., Camden, N. J., with a PTFE-impregnated bronze material, were fully reported in MPl, Feb. 1959, p. 123.

From The Polymer Corp. of Pennsylvania, Reading, Pa., come details of Fluorosint, a "material comprising polytetrafluoroethylene and other specially developed constituents designed to improve the material's mechanical and thermal properties." Again, high PV values and low wear characteristics are claimed, together with low thermal expansion, close molding tolerances, and stability against thermal shock.

A different approach to the utilization of the unusual frictional properties of PTFE is the use of the material in the form of oriented fibers. Attention was first called to the bearing possibilities of these fibers by Du Pont. They have about 25 times the tensile strength of the resin, with a proportional increase in resistance to creep. Bearings with surfaces of woven PTFE have shown excellent service characteristics in unlubricated high-load, low-speed areas.

Prominent in the field of bearings using Teflon fibers is The Russell Mfg. Co., Middletown, Conn. In its Ruslon bearings, the company uses a fabric base woven of cotton and PTFE fibers. This fabric is impregnated with a high-strength heat-resistant phenolic (Union Carbide Plastics), air dried, and cut to shape. The laminate is then bonded to a metal backing under a pressure of 7 to 10 tons/sq. in. at a temperature of 340° F.

Russell explains the claimed efficiency of its bearings in this way: strength is gained by the



INJECTION MOLDED nylon bearings can be precision-produced to design specifications. Snap-in type are molded by Thomson Industries Inc., with engineered slot to permit close bearing fit yet allow for expansion caused by water absorption and rising temperature. Same slot principle is used in other molded Thomson bearings ranging in I. D. from 1/8 to 3 inches.

Recommended uses for plastic bearings*

Phenolic Laminates: Marine shafts; steel mill and other heavy-duty machinery; automotive suspensions; pumps; aircraft landing gear; clock motors; electrical appliances and switchgear; retainers for high-speed, super-precision ball-bearings.

ADVANTAGES: *High shock absorption; good machinability; can be lubricated by water; resistance to oils, greases, and mild chemicals; light weight; reduced vibration.*

Polytetrafluoroethylene (molded with various fillers and reinforcements, and in molded fiber or fabric form): automotive knuckle and ball joints; jet engine after-burners; instrument bearings; railroad car trucks; bridge bearings; roller conveyors; agricultural equipment; food and textile processing machinery; aircraft and missile control surface bearings.

ADVANTAGES: *Low coefficient of friction; high temperature resistance; excellent performance at extreme low temperatures; no lubrication required but can be used; high shock resistance; impervious to most chemicals, solvents, and oil; good machining qualities; vibration absorption; low wear rate.*

Nylon: Automotive king pins, pedal shafts, seat swivels, door handles, etc.; typewriter shift levers; washing machine idlers; swinging shelves in refrigerators; baby carriage and tricycle wheels; hinge pins for dampers in industrial ducts; movie projectors; door rollers; jalousie windows and doors; farm machinery; textile machinery; marine steering and other controls; pin-ball machines; electric shavers; ventilating fan louvers; water and gas meters; food wrapping machinery.

ADVANTAGES: *Low coefficient of friction; no lubrication required but can be used; quiet operation; good chemical resistance; low wear rate; abrasion resistance; ease of molding to close tolerances.*

Acrylonitrile-Butadiene-Styrene: Used in lawn mower and roller-skate wheels, where wheels and bearings are integral. Under evaluation for pulleys, drapery traverse rods, industrial dolly wheels.

ADVANTAGES: *Low coefficient of friction; high abrasion resistance; low creep; low mold shrinkage; no lubrication required but will tolerate conventional oils and greases.*

Acetal (Du Pont's Delrin): Chair caster wheels; industrial truck wheels; door hinges; truck steering gears and pedals; drapery slides; lawn mower rollers; electric shavers; bicycle steering heads; egg beaters; conveyor belts.

ADVANTAGES: *Low coefficient of friction; no lubrication required, but can be used; rigid but tough at high and low temperatures; low creep; resistant to solvents and lubricants.*

Polycarbonate (GE's Lexan): Still being evaluated for both sleeve and ball bearings. Has advantages of relatively low coefficient of friction, good creep resistance over a wide temperature range, high impact strength, and ease of machinability.

Chlorinated Polyether (Hercules' Penton): Still under evaluation in fertilizer mixers, in sump pumps for sewage disposal plants, and in other process equipment where its combination of properties is desirable.

ADVANTAGES: *Low coefficient of friction; chemical resistance; very low creep under load at elevated temperatures; practically zero water absorption; dimensional stability.*

*This listing makes no attempt to cover all uses of all plastics in bearings. It was compiled to indicate the diversified possibilities. Manufacturers of materials and suppliers of bearings should be consulted when considering the use of plastics bearings for a specific application.

use of cotton and phenolic; shock resistance is increased by the molding pressure and temperature; low friction comes from the Teflon fibers. In use, the PTFE fibers flow to produce a thin, continuous "plating" of PTFE on the bearing face and on the mating metal surface. Cost is kept low by using a relatively small amount of PTFE fibers in the fabric base.

Principle use for PTFE fiber bearings thus far is in automobile knuckle and ball joints where long life and freedom from periodical greasing are desirable. In one simulated travel test, a steering knuckle bearing showed no sign of wear after the equivalent of 200,000 miles. At least two major car manufacturers have reportedly adopted Ruslon bearings.

Nylon

While nylon-6/6 has a low coefficient of friction and can be used either lubricated or unlubricated, it has high water absorption and thermal expansion characteristics. Two general approaches have been taken to overcome these drawbacks: additives and bearing design.

By using molybdenum disulfide as a filler for nylon, Polymer Corp. produces a material (Nylatron GS) which is reported to have thermal expansion less than 65% of that of Zytel 101 (Du Pont) nylon. Zytel 101 is generally considered in the trade to be the best straight nylon formulation for bearings. Polymer Corp. also produces parts, under the tradename Nylasint, by cold pressing nylon powders alloyed with inorganic additives. These parts are claimed to have lower hygroscopic and thermal expansion, and to have structures of controlled porosity which can absorb substantial quantities of oil.

Thomson Industries Inc., Manhasset, N. Y., has concentrated on design to overcome the limitations of plain nylon. The Thomson approach is to injection mold its bearings with an engineered expansion gap or **(To page 181)**

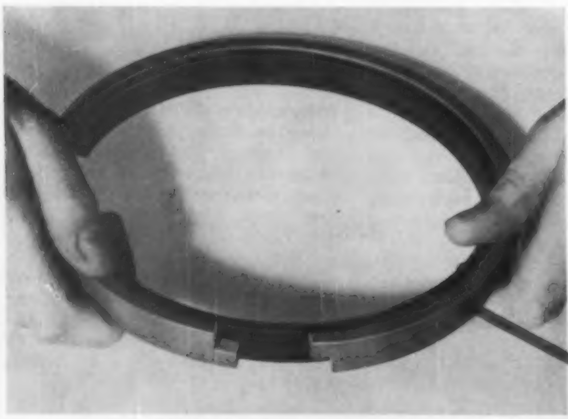
Reinforced Teflon rings lower costs for air compressors

A 20-fold increase in service life of air compressor piston rings has been achieved by switching from cast iron to reinforced Teflon. In addition, use of the TFE-fluorocarbon parts made possible a reduction of the number of rings for the application from 26 to six.

On an installed basis, the self-lubricating Teflon rings cost about the same as those of graphite and from two to three times as much as cast iron rings; however, the vastly extended service life (2000 against 100 hr. in one test reported by Du Pont) and the reduction in the number of rings required makes the changeover highly economical.

Results cited here were obtained in plants where the equipment operates under highly corrosive conditions. In addition to chemical resistance, the Teflon rings withstand pressures up to 4500 p.s.i and operate satisfactorily at temperature extremes ranging from —320 to 500° F., where conventional lubricants are completely useless.

Such rings are currently fabricated by Koppers Co. Inc., Metal Products Div., for such users as Worthington Corp. (in its Buffalo plant), Ingersoll-Rand Co. (in its Phillipsburg, N. J. facility), and others.—**End**



REINFORCED TEFLON RING, 14 in. in diameter, is installed in a single-stage air compressor, right. Photo above shows close-up.

R$_x$ for diversification—blow molding

Two recent expansion moves point the way to a new role for the latest plastics processing technique. Advances in resin technology and ingenuity of parts design also contribute to growing acceptance

Diversification, that mid-century effort at corporate growth with stability, has found a new route in blow molded polyethylene. Two major U. S. companies, branching out into new product lines, have turned to the economies of the process and the versatility of the resin to launch their new enterprise.

Fuller Brush Co., a major producer and distributor of household aids, expanding into the babies' cosmetics market, went to custom blow molded low- and medium-density PE for the container in which to package its products.

Gerber Products Co., well-known manufacturer of baby foods, moving into the area of infants' toys, chose a special, recently developed, bacteriocidal formulation of medium-density resin to blow mold its way to success in a highly competitive field.

The significance of these moves, one following closely on the heels of the other, is not being lost on analysts of the plastics industry.

1. They point up the potential of the latest plastics processing technique at end user level.
2. They show that close attention to formulating can result in materials that meet the requirements of a vast range of applications.
3. They represent proof that the economies of blow molding are right; that, together with polyethylene's properties, the process offers a serious challenge to established materials; and that the optimistic growth forecasts made for the new technique a few months back are very likely to be attained or exceeded.

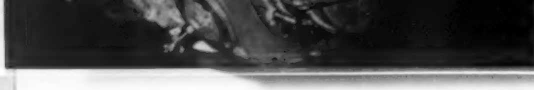
The Fuller Brush story

The company's major competition makes large use of glass containers to stress product cleanliness. Fuller, by sealing each plastic con-

Four-color plates, Fuller Brush Co.

FULLER'S Perky Pixie shampoo container is decorated in colors safe for children. To minimize abrasion, spray-painted areas are recessed.

BLOW MOLDED BOTTLES, humorously shaped to serve as children's toys when empty, include (from left): a Bashful Bear containing talcum powder; a Funny Fellow with baby oil; and a Pensive Penguin with baby lotion. Bear has a sifter cap for powder dispensing, latter two bottles have swing-spout dispensing heads.



DECORATION OF BLOWN BOTTLES is performed in this area at Wheaton Plastics Co. There are two conveyorized lines (only one is shown), each with two spraying stations, since two colors are added to basic molded-in hue. Note bin of undecorated bottles in foreground, next to two-cavity spray masking plate.

tainer in a polyethylene film bag, has not overlooked this selling point. But they have gone a step further by creating a product package with a definite nursery appeal and one that doubles as a child's toy. And though the cost of a blow molded PE bottle is about 10¢ more per unit than a comparable 6-oz. glass container, Fuller can justify the extra cost by the strong consumer appeal of the ingeniously decorated package and by the fact that their product is a toy as well as a toiletry container. Apparently the public is intrigued by the plastic-housed products; they have been introduced into the Northeastern states and reportedly have drawn excellent buyer reaction.

Five items are involved: 1) a Perky Pixie for shampoo; 2) a Pensive Penguin for baby lotion; 3) a Bashful Bear for powder; 4) a Funny Fellow for baby oil; and 5) a Baby Block (squared jar) for skin cream.

All containers but the Funny Fellow are custom blow molded in medium-density Du Pont Alathon by Wheaton Plastics Co., Mays Landing, N. J. The Wheaton process is a two-stage operation in which a molten parison is produced by injection molding, then transferred to the blowing cycle. The Funny Fellow oil bottle, of low-density Alathon lined with a polymer coating to prevent oil migration, is blown for Fuller by Plax Corp., Hartford, Conn., using an extrusion-blowing method. A polypropylene comb and brush, part of the

AT SPRAYING STATION, operator places bottles, two at a time, face down into cavities. Air-operated sponge rubber pads hold containers in place while color is sprayed from beneath masking plate. Bottles are then conveyed by belt through drying oven (see photo at right).

BOTTLES EMERGE on conveyor belt from drying oven. Here, operator hand-applies appropriate colors to any incompletely sprayed areas.

new set, are injection molded by Fuller in its own plastics department at East Hartford. Both items are molded from Hercules Pro-fax polypropylene on an 8-oz. Reed-Prentice machine, the comb in a 12-cavity mold and the brush block in a four-cavity mold. The complete set, which also includes three pieces of infant soap, fetches a healthy $11 in door-to-door selling, Fuller's special brand of distribution.

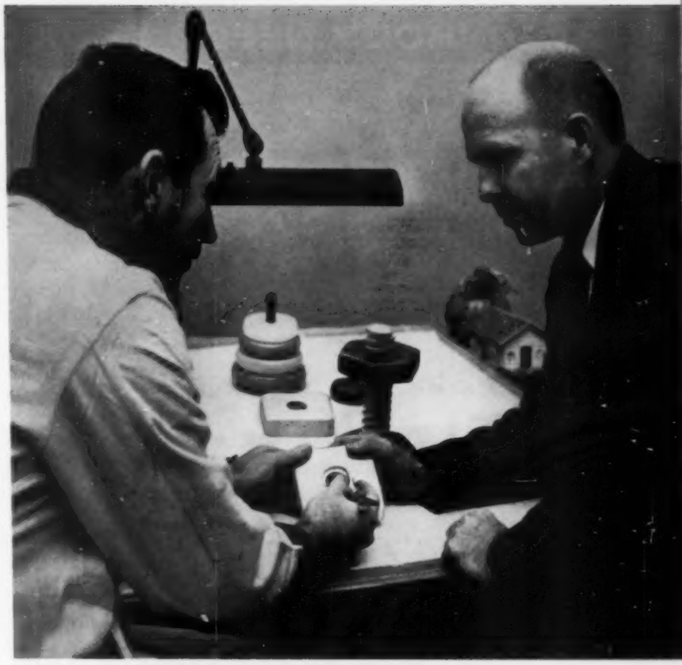
Problems, modifications, solutions

The original design work was started by Eric DeKolb, New York stylist, in February 1959, and just 10 months from that date the blow molders began production. In the time between, the sketches were modified by Fuller research and further adapted to the requirements of blow molding by Fuller and Wheaton engineers. The necessary modifications were designed to eliminate sharp undercuts in the figures so that wall areas could be controlled and stress cracking prevented. For example, the feet on the Funny Fellow bottle, extending out to the side in the original drawings, were moved inward to eliminate the sharp edges, moved out in front to provide better stability, then cut back on the bottom edge to obtain a more uniform wall thickness.

However, the biggest problem was that of decorating. Colors used were types approved by the American Standards Assn. for "baby consumption," and these have a tendency to scuff under hard usage. The solution was reached through design modification: in those areas where color was to be added, the surfaces were recessed to prevent abrasion and to provide definite cut-off points during application.

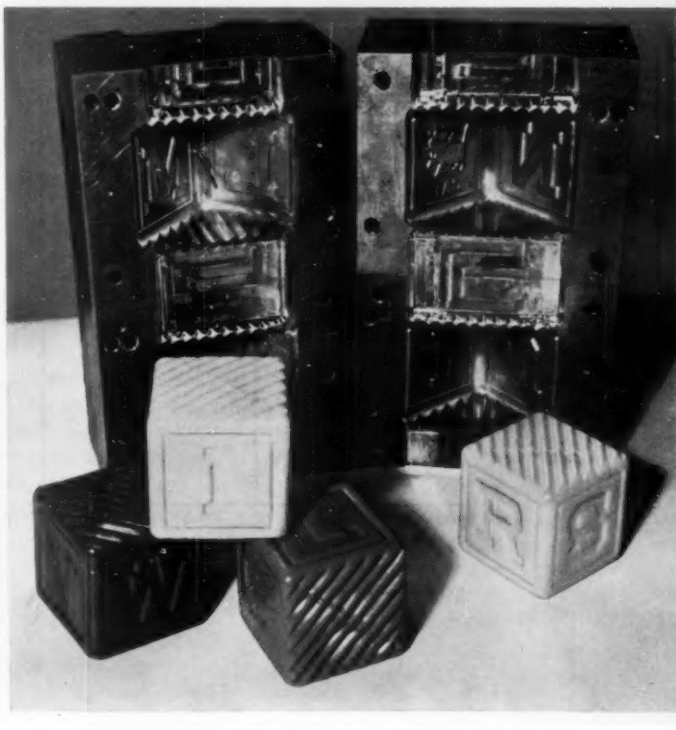
How it is done

Wheaton decorates their blown bottles by means of a two-station, conveyorized system. All containers are flame treated, then delivered to the first station. The operator places the containers, two at a time, in an inverted position into two spraying cavities. The cavities act as masks, allowing the introduction of paint only on those areas to be decorated. Air-driven sponge rubber pads hold the bottles in place while the paint is sprayed from beneath the cavities. The bottles then pass through a drying oven and are returned to a second spraying station, since two colors are added to each container. A second drying cycle and hand touch-up of those areas found by simple inspection not to be completely sprayed completes the operation. Because of the fab- (To page 183)



BLOWN "DOUGHNUT" is a development of Gerber's program, here discussed by Robert Walter (left), designer, and Thomas R. Graham, general manager. This principle is applied in nut-and-bolt in center and stacking toy (rear).

BOTH HALVES of two-cavity mold used by Gerber to blow mold alphabetical blocks of Dow's Surfaseptic polyethylene.



EVERYBODY NEEDS EPOXIES (conclusion)

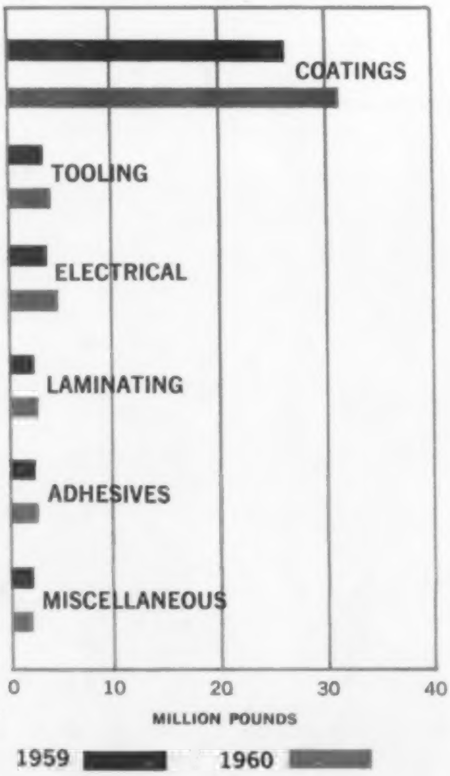
Six steps to increased epoxy uses

By John Rothschild* and James J. Maher†

The MODERN PLASTICS series of articles on epoxy resins has indicated a wide variety of uses for these relatively new materials. Implicit in the series were six reasons why more epoxies will be used in more applications.

1: Savings. When the use of epoxies either puts money in his pocket or helps keep it there, a user willingly and happily jumps on the epoxy bandwagon. These savings result from the fact that epoxies are often easier to process than other materials, and frequently produce long-term savings by performing a given job better for a longer period.

Fig. 1—Epoxy Consumption by End-Use



Tooling and plant maintenance applications are two fields that have developed into sizable epoxy markets because of the demonstrable savings which accrue to users. Surface coatings formulated with epoxies frequently result in savings despite the higher initial cost of the epoxy-based materials because they prove economical in terms of either fewer and thinner coats yielding equivalent performance, or a standard coating yielding much longer life.

2: Superior performance. Adhesives, potting and encapsulating, laminating, and some coatings applications come to mind as proof that when performance is the criterion, epoxies pay off. In terms of potting and encapsulating, epoxies have captured the major share of a previously small market. They have done well in the adhesives field, but have not won the market share they merit—possibly because of formulators' reluctance to promote complex systems and because of the availability of lower performance, but adequate, low-cost systems.

Superior performance and savings are two routes that are traditional in product pioneering in the United States. They have been primarily responsible for epoxies achieving their present annual consumption rate of 38 million lb. (1959). Fig. 1, left, shows how these 38 million lb. are consumed in terms of end use. Based on industry growth patterns, we project a volume of 46 million lb. for 1960.

3. Improved resin and application technology. Epoxy adhesives and coatings are not as easy to

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The authors wish to express their thanks and indebtedness for statistical information and background material obtained from "Epoxy Resins—Market Survey and Users' Reference," Materials Research, Box 363, Cambridge 39, Mass.

work with as solvent-based or air-curing systems. The expansion of the market for epoxy-based adhesives will require greater simplification of the methods of handling currently being used. Considerable progress has been made in this area chiefly by means of improved packaging and formulation.

That much more can be done is evident from the fact that only a small portion of adhesives used for installing floor and wall tile, where the waterproofing properties of a cured epoxy adhesive really would be highly desirable, are epoxy-based at the present time.

Similarly, the increase of the market for epoxy-based trade-sale paint products, involving two component and high performance systems, requires simplification of the methods of using these materials so they will require less attention and skill to obtain satisfactory results. Since many production line systems actually use compounded materials containing fillers, modifiers, and other additives, constant improvement of the performances of dispensing equipment and the various other production operations is required.

In applying floor and road surfaces, obtaining a surface of uniform thickness and resin-hardener homogeneity is imperative. Although the industry is striving to develop suitable surfacing machinery, much must be done before buyers will risk heavy investments on equipment capable of handling large volumes of epoxy-based surfacing materials.

In like manner the break-through on structural adhesives in building will probably not occur until the handling problem is solved so a construction worker can use epoxy adhesives as easily as hammer and nails.

In addition to improved handling characteristics, technological advances in resin "alloys" can be anticipated. That is, by blending or reacting epoxy resins with other resinous materials such as phenolic or melamine resins, new resin systems (i.e., "alloys") will be developed. These alloys will have their properties tailored to the needs of specific problems. High performance alloys show promise in solving the problem of temperature- and abrasion-resistant surfacings for space vehicles.

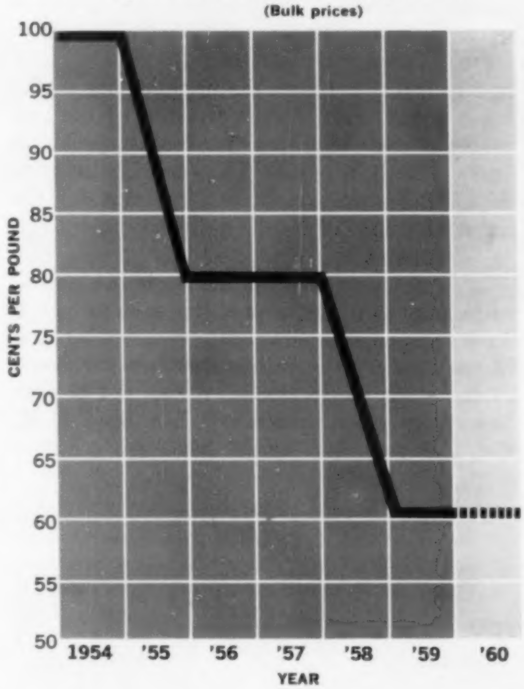
Related to this technique is the bituminous modification of epoxies, in which coal-tars or asphaltic materials are used as fillers at very high concentrations. Although the amount of epoxy used is small compared to the amount of filler required, the resultant mixture has nevertheless significantly improved properties that warrant the use of epoxies with these relatively low-cost materials.

4. Education. Having built a better mousetrap, many in the epoxy field have been disappointed because the world is not yet at their doors. This MODERN PLASTICS series has helped highlight many epoxy applications, but a considerable amount of user and consumer education still remains to be done.

For example, despite the unquestioned performance of epoxy-based traffic paints, aggregate-filled traffic markings, and anti-skid road surfacings, applications in which price considerations should, of course, be secondary, epoxies have yet to capture their deserved share of this lucrative market. Similar situations exist in tooling, piping, and adhesives, as well as reinforced plastics molding.

Possibly the earlier attitude of suppliers, namely, "epoxies are the greatest," created an unhealthy skepticism among potential users that is only now being dispelled. Part of this problem has been a natural reluctance on the part of material suppliers and formulators to

Fig. 2—Price History of Epoxy Resins
(Bulk prices)



make public what they consider "trade secrets." This has led to the printing of reams of material in a great many trade papers that merely hint at how epoxies can be used, but which leave the reader unenlightened. While such an approach by the supplier may be considered justified, he must be aware of the impact on potential users. In view of this, perhaps the best means of educating users is continued advertising, stressing case histories of how and where epoxies are used, including savings-performance data as well as other improvements brought about by their use. In this, MODERN PLASTICS showed leadership by publishing this series of articles.

5. Price. While not the primary route toward increased consumption, the price of epoxy resins must be considered as a long range factor in their increased usage.

Fig. 2, p. 105, shows the price history of the basic epoxy resin. An appreciation of the raw material costs and resin production problems leads us to believe that the present basic price of about 62¢ per pound will continue for the near term and only small price reductions can be anticipated in the future.

It is noteworthy that, although the appeal of savings is a strong one, the savings which have accrued to epoxy users were not because of the epoxy price; rather they are the result of the epoxy performance. We do not believe the epoxy price, whether it had been $1.00, 65¢, and even 60¢, would have had a major effect on past epoxy sales. In the future, however, continued reductions in epoxy resin prices will be a beneficial long-range pressure for increased usage, particularly in markets such as adhesives where first-time price is frequently more of a decision factor than savings or performance.

6. New developments. Each day many thousands of researchers, sales representatives, market analysts and numerous other interested personnel turn over the question, "Where else can we use epoxies?"

This question has been successfully answered by such recent applications of epoxies as the bonding of protective glass fronts directly to the face of television tubes, the production of molded foam products from expandable polystyrene beads which are simultaneously expanded and bonded together by a highly exothermic room-temperature-curing epoxy system, and epoxy pipe-lining.

Over the coming year, there are many fields in which epoxies could find wider use, such as in non-woven fabrics, fabric treating, garment manufacture, costume jewelry manufacture, footware, optics, safety glass, transportation equipment, construction, process equipment, and piping. All of these are presently being investigated by materials suppliers, formulators, and companies in these fields.

A prediction

To achieve the long hoped-for volume of 100 million lb. annual consumption, epoxies will have to be considered as an easy-to-use, problem-free engineering material—much as polyesters are regarded. In addition, they will have to penetrate new markets. This means some of the glamour may have to be knocked off them: they will have to stop being treated as "wonder materials" for there simply are not enough "wonder" jobs to achieve a high annual consumption at the present time.

Because we feel the epoxy industry will actively pursue all the suggested routes to increased usage, we believe the hoped-for volume will be sold within the next three years. Our market breakdown of how 100 million lb. of epoxies will be consumed in 1963 is shown in Table I, left.

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This is the concluding article in our epoxy series, which began with the July 1959 issue. For quotations on reprints of the entire series, write Reprint Mgr., MODERN PLASTICS, 575 Madison Ave., New York 22, N. Y.

Table I: Projected epoxy markets for 1963

END USE	MILLION LB.
Coatings	50
Tooling	6
Potting and encapsulating (including insulating)	10
Laminating	4
Adhesives	4
Automobile production body solder	2
Floor and road surfacing	6
Boat surfacing	3
Piping	4
Process equipment	4
Television tubes	2
Optics and safety glass	2
Miscellaneous (including amine adducts and vinyl stabilizers)	3
Total:	100

Resin board for low-cost molding

SOME OF THE ITEMS produced of phenolic-impregnated kraft. Globe and instrument case are experimental. Luggage, duck decoy, trays, and automotive parts in foreground are all in commercial production at the present time.

A kraft paper-board impregnated with phenolic resin opens up new possibilities for molding a wide range of products with relatively low tool costs at a high production rate.

The new material, developed by Consolidated Paper Co., Monroe, Mich., is currently being used for luggage, music cases, air ducting, mannequins, decoys, gaskets, and automotive parts. For these applications, the most commonly used boards contain 25 or 40% resin by weight, but the company also produces other combinations, made with both thermosetting and thermoplastic resins.

How board is processed

The shapes are produced by cutting the board to size, and placing it in a steam chamber where heat liquefies the resin while the kraft fibers absorb sufficient moisture to make the sheet pliable. The sheet is then placed in a heated mold—made either from cast aluminum or cast iron—and formed. A temperature of 300° F. is required to cure the phenolic resin fully. The total press time is 3 min. at 1000 p.s.i.

Many products are formed that do not require full cure for end use, and lower mold temperatures, at pressures from 300 to 500 p.s.i., can be used, with a dwell of 10 to 20 seconds.

At present draws are limited to about 3½ inches. Deeper sections can be fabricated with a wraparound insert of the same material, either stitched, stapled, or cemented together to give a deeper piece of luggage. Another method is to have the male die come into the draw at an angle, so that a deeper draw can be obtained in the center.

By drawing vinyl sheeting over the paper form, a high quality finish can be obtained. It can also be embossed or painted, and the formed surface of the phenolic resin provides a good base for baked-on enamel.

This dimensionally stable board is also expected to be used for large toys, electric housings; as the main structural member in free-form furniture, laminated with foam. The noise reduction factor also suggests its use for vacuum cleaners and other household appliances.

The impregnated board is supplied in sheets up to 66 by 72 in., in caliper thickness from 0.060 to 0.200 inches. Prices for a phenolic impregnated board, 0.060 in. thick and a 25% resin content is 61.37¢ per 1000 sq. in., or roughly 8½¢ per sq. feet. A 25% resin content thermoplastic impregnated board of the same thickness runs 40.23¢ per 1000 sq. in., or about 5¾¢ per sq. foot.

Among companies processing the material at present are Woodall Industries Inc.; Fabricon Products Inc.; Detroit Gasket Co. (all producing automotive parts); K & W Decoy Co., (producing the duck shown in the accompanying illustration); Skyway Luggage (maker of some of the suitcases shown); Darling & Co. (mannequins); and others.

According to Sundberg-Ferar Inc., industrial designers, Detroit, Mich., who have had considerable experience developing products using this material, "it opens up a host of new possibilities replacing wood and metal products, frequently at a significant price advantage and an improvement in quality."—End

Plastics in the product revolution:

Trying to imagine today's radio and TV sets without plastics is like picturing beer without pretzels or Amos without Andy.

In the infant days of radio, plastics played only a small, though highly functional, role. One can recall some of the first cumbersome vacuum tube sets with their exposed chassis and morning-glory-inspired speaker horns. During the late '20's, molded phenolic components won acceptance in such applications as tube sockets and bases, electrical insulators of various kinds, and calibrated tuning dials. Front panels, fabricated of phenolic laminate, marked a first step toward fully enclosed radio cabinets.

Actually, plastics and electronics have grown up together. And their growth has been so pronounced that they have, in recent years, outpaced virtually all other types of industries. In 1922, when total U.S. plastics production reached only 5,944,000 lb., only 100,000 radios, valued at about $5 million, were produced.

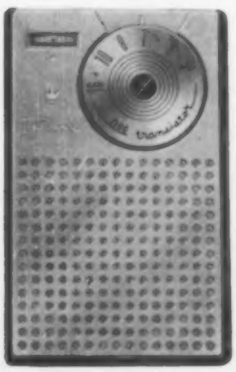
In 1934, when output of synthetic resins and cellulosics ran 56,059,000 lb., fewer than 4½ million home and auto radios were produced. Portable radios (1939), clock radios (1951), and the miniaturized transistor set were yet to come. By 1959, when plastics production topped 5½ billion lb., output of radios was running well over 10 million units per year, while TV sets had reached an annual volume of about 6 million units.

World War II, with its heavy dependence on compact, highly mobile communications equipment, accelerated many electronics developments and lead to a stepped-up usage of plastics in the walkie-talkie and other military electronics equipment. But even before the war, table model radios had gone predominantly to plastics cabinets, and color was becoming more important as small sets made their appearance in the home. Urea became a highly favored material for molded cabinets, offering an almost unlimited color range to supplement the darker hued phenolic cabinets. Special "long flow" type urea compounds were developed to provide improved molding characteristics. During the '30's, nearly one-fourth of the output of American Cyanamid's Beetle urea molding material was going into radio cabinets. The extra sales appeal of the light colored urea models often enabled them to carry a retail price premium.

Molded plastics cabinets proved ideally suited for the restyled postwar table models and the new battery-powered portables—hardly portable by today's standards—which broke radio's dependence upon electrical outlets. Meanwhile, plastics were gaining in usage for vinyl wire jacketing, insulating sleeves, connectors, and other internal parts.

New material, new progress

During the '50's plastics recorded their greatest progress in the radio field. With the development of new materials—impact styrene, cellulose propionate, ABS polymers, etc.—injection molded plastics moved more strongly into the radio cabinet picture, eventually leaving thermosets only a small share of this market. Their full color range, toughness, broad design capabilities, and rapid production cycles spelled production and merchandis-



FIRST true pocket radio, the Regency, had case of medium-impact styrene.

CURRENT RADIO HOUSINGS USE

Implex modified acrylic

Forticel propionate

THE RADIO

THE COVER: The transformation of radios from the cumbersome contraption in the background (RCA, ca. 1924) to today's sleek instrument was sparked to large extent by plastics.

ing advantages which manufacturers could not afford to overlook. Milestones in this switch to the new, tougher plastics cabinets included the introduction of Dow's Styron 700 (1953), the first thermoplastic to win Underwriters' approval for cabinets, and RCA's famous Impac case, which was molded of Marbon's Cycolac ABS resin.

In recent years, miniaturization of radio sets and other electronic equipment received its greatest impetus from two major developments —the introduction of printed circuits (made possible by plastic laminates) and the perfection of tiny transistors, which took over many of the functions of the vacuum tube. These advancements set the stage for the first true pocket radio, the Regency model, which was introduced in 1954 by Industrial Development Engineering Associates Inc., Indianapolis, Ind. Measuring only 3 by 5 by 1¼ in. and housed in a handsome medium impact styrene case, it weighed only 12 ounces.

Today, most radio manufacturers include in their line one or more transistorized pocket models, along with a variety of table models, clock radios, and conventional portables. Even sun-powered portables, with silicon cell assemblies sealed in a combination acrylic and impact styrene enclosure, have made their appearance. The first of these sets, announced by Admiral in 1956, used extra-high impact styrene for the outer cabinet, which included 14 major plastic parts.

Currently, the plastics most frequently used in small radio cabinets include impact styrene, cellulose propionate, butyrate, ABS resins, modified acrylic, and nylon. Such materials possess adequate strength properties for both the cabinet and the handles on the larger-type portables. Polypropylene, in view of its outstanding lightness, strength, and scuff-resistant surface in molded parts, may become an important new contender as molders gain increased knowledge of its handling properties.

One leading supplier of styrene molding materials estimates that about 8 million lb. of thermoplastics went into radios produced in the U. S. in 1959, with an average of about ¾ lb. of thermoplastics per set. Table top and clock radios now average about 1 lb. of thermoplastics per set. These figures are in addition to the interior components, which are mostly phenolic, and include a strong trend to printed circuits utilizing phenolic-based laminates. Of course, the volume of plastics used in radio manufacture does not accurately reflect how thoroughly plastics now dominate the cabinet field. Because of miniaturization, the average amount of plastics used per set is much smaller than in the larger sets of several years ago.

Today's plastic cabinets are colorful, smartly styled, and light in weight. And tomorrow's prospects for radio and TV sets look very good indeed for plastics!—End

A VARIETY OF PLASTICS MATERIALS

High-impact styrene

Nylon

INSIDE the transistor. Printed circuitry, largely responsible for the miniaturization of present-day radios, is built on phenolic laminate board.

Building a giant

Design, construction, and erection of a 140-ft.-diameter reinforced plastic sphere to house a radar antenna for RCA is typical of the techniques that may be used tomorrow to build homes and skyscrapers of plastics

By George C. Fretz†

As radar transmission stations become more powerful and their range is extended, larger antennas are needed. Also needed are larger radomes to protect the antenna from weather. When the Radio Corporation of America and the Navy asked us to build a radome to house one of their monster antennas in a 140-ft. radome, we were faced with many problems in design, production, and erection. This article is a report on how these problems were solved in building the world's largest radome.

General design

The radome shown completed at right contains 1646 modules or panels grouped in 12 equal sections: this particular arrangement is derived from a dodecahedron, a spherical body with 12 identical pentagonal faces (including top and bottom). Each pentagon is further divided into hexagonal and pentagonal sections with a pentagon at each vertex or juncture of the large subdivisions. Figure 1, p. 112, shows the geometric break-down of the spherical units.

Choice of panels was determined by fabrication, packaging, and handling considerations. The panels selected range from 25 to 35 sq. ft. in area and weigh from 90 to 135 pounds. The average panel weighs 125 lb. and has 31 sq. ft. of area. There are 10 basic panel shapes; all have the same curvature, namely, a 70-ft. radius. Figure 2, p. 112, illustrates a typical panel. Sixty of the panels are cut to form base-ring or mounting panels. Since these panels are sections of standard panels, they can be made with basically the same tooling as the others.

The attachment of one panel to another to form a complete sphere posed a formidable mechanical problem, since construction had to be done in the field under adverse conditions. Considerable de-

COMPLETED RADOME. Interesting is the fact that any one panel can be removed without disturbing solidity of the structure.

*Reg. U. S. Pat. Off.

†Engineer, Goodyear Aircraft Corp., Akron, Ohio

Adapted from a paper presented at the 15th Technical and Management Conference of the Reinforced Plastics Div., S.P.I., Feb. 1960, Chicago, Ill.

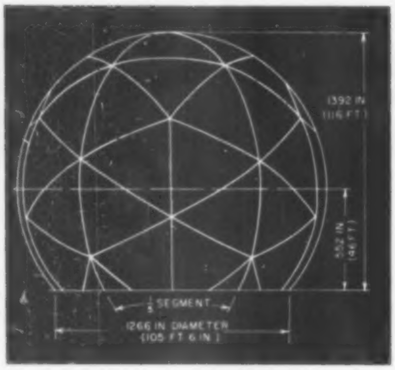


FIG. 1: Diagram showing how a true sphere was broken down into panels on the basis of a dodecahedron.

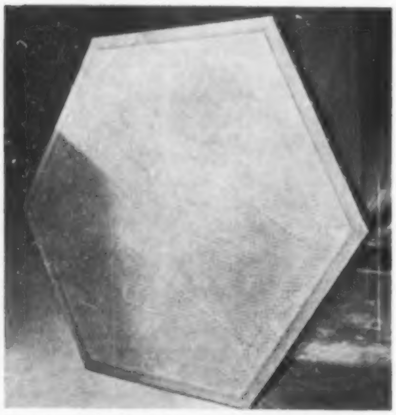


FIG. 2: A typical hexagonal panel used in the radome construction, 6 ft. across. Pentagonal panels were also used in the structure.

sign experimentation, sample fabrication, and testing established that there should be no holes in the outer surface because they would be difficult to keep sealed in extreme climates. Therefore, it was decided to fasten the panels to each other by bolting their edges together by working from the inside of the spherical shell. To do this access holes were routed out on the inside surface of each panel directly opposite the mating bolt holes in each panel. This allowed a man to slip C bolt through the edge of the panel with driving tools and tighten it with offset wrenches, and did away with the necessity of having external fastenings.

Table I: Dimensions of individual panel

Basic skin thickness	0.042 in.
Edge-channel size	
Width	6 in.
Depth	225 in.
Thickness	0.200 in.
Honeycomb core	60-P-60 Kraft paper, ¾ in. cell, 6 in. thick
Edge reinforcement	Fibrous glass-reinforced plastic skin material 6 in. wide around edges on inside and 2½ in. wide on outside
Resin material	Hetron 92 fire retardant resin

Structural design

The structural design on the new unit began with the size requirements established by preliminary electrical work and by wind and climatological specifications. The contrast specified general requirements for three sets. The radome had to be capable of withstanding a 185-m.p.h. wind on the first site; and 130 m.p.h. at the second and third sites. These figures are based upon wind density at −10° F. The temperature requirements are −65 to 160° F.

From wind-tunnel tests on several models,[1] calculations were made to determine all loads on a surface of the radome and transmitted loads into the mounting ring and building. From the surface loads, individual panel requirements were obtained; then skin gages and channel-edge gages were established along with the strength requirements of all joints between parts. The proper design factors for testing and processing were incorporated. These include weathering factors, no-damage factors, and a safety factor. A combination of the detail parts requirements based upon the mechanical and structural design and testing were presented to the processing group to determine their suitability for tooling purposes as well as materials applications.

Electrical design

Initial designs for the radome were based on metal-space-frame construction because of the great size of the unit. However extensive preliminary tests showed that, because of the electrical requirements, the honeycomb sandwich was a more ideal approach to the problem. It provides better electrical transmission and had been proved a strong and stable structural unit. To check its electrical qualifications, a scale model was made and tested over an equally scaled-down antenna.

A correlation of the electrical

FIG. 3: Molds used in the production of panels. Note adjustable mold sides on panel in foreground used to make odd-shaped panels. Mold pictured at middle left is shown with panel covered with insulating blanket in the curing stage of the process.

[1] J. W. Bezbatchenko: A Study of Aerodynamic Loads on Large Spherical Radomes for Ground Installation. Presented at Symposium on Rigid Radomes, Lincoln Laboratories, Massachusetts Institute of Technology, Cambridge, Mass., September 8 and 10, 1958; published in the proceedings.

design and test results with mechanical as well as structural requirements resulted in developing a radome having the following electrical characteristics:

Transmission efficiency	98%
Boresight-error average	0.1 mil
Boresight-error maximum	0.3 mil
Boresight error rate	0.005 mil per mil
Pattern distortion	Very small

Process design

The detail radome design was presented to the tooling and processing group to determine most economical method of manufacture. Concurrently, proposed full-scale part configurations were fabricated and tested in the laboratory and process changes evaluated to obtain the most efficient joints and the most effective use of the materials. These material and process evaluations resulted in the individual panel dimensions shown in Table I, p. 112. The dimensions shown in the table are for the 130-m.p.h.-wind model, which was the first unit designed and built.

Fabrication

For the most efficient and rapid production, tools were designed to be common to every panel. All panels were made on spherical male molds having a 70-ft. radius. Movable-edge members were attached to these tools, which permitted the fabrication of any panel on any mold and, therefore, gave production flexibility. The molds were made of steel and integrally heated with steam. Even heat distribution was obtained by the use of electric blankets on top of the panel and an insulating blanket to retain this heat. To obtain the necessary pressure for holding together all components during cure, a rubber vacuum blanket was clamped over the part in the mold. The cure cycle took place under approximately 12-p.s.i. vacuum pressure. Figure 3, p. 112, shows this final tooling in operation.

All channel parts were made on curved matched metal dies in a large press and then cut to length for specific panels and punched for the attachment-bolt holes. To distribute the attaching-bolt tension loads from the web of the channel to the flanges, it was necessary to bond aluminum plates into the channel as shown in Fig. 4, above. The honeycomb core was cut to size to fit into the panel framing. The assembled panel was cured under a combination of steam and electrical heat, while the vacuum pressure held all components together. The completed panels were painted on conveyor system with two coats of Hypalon rubber-base reflective paint and sent twice through a drying oven.

FIG. 4: Aluminum plates being bonded to reinforced plastic channels, which form the edges of the panels. Plates were used to distribute loads of fastening bolts uniformly over the entire channel.

Packaging and shipment

After the finish painting, vinyl tape was applied over the access and bolt holes of the panels. They were then approved for final operations and final inspection by quality-control representatives of Goodyear Aircraft and the Navy. The panels to be shipped in the continental United States were

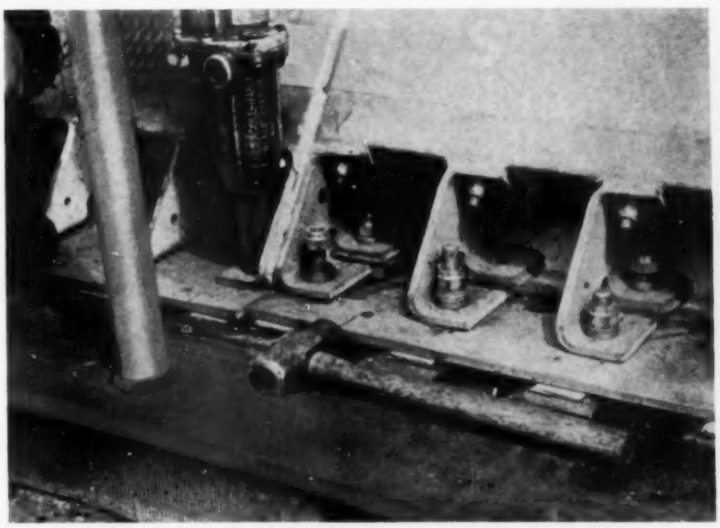


FIG. 5: Base ring panels were fastened to building as shown. Over 1200 bolts hold the radome down and distribute the load to the building structure and the basic foundation.

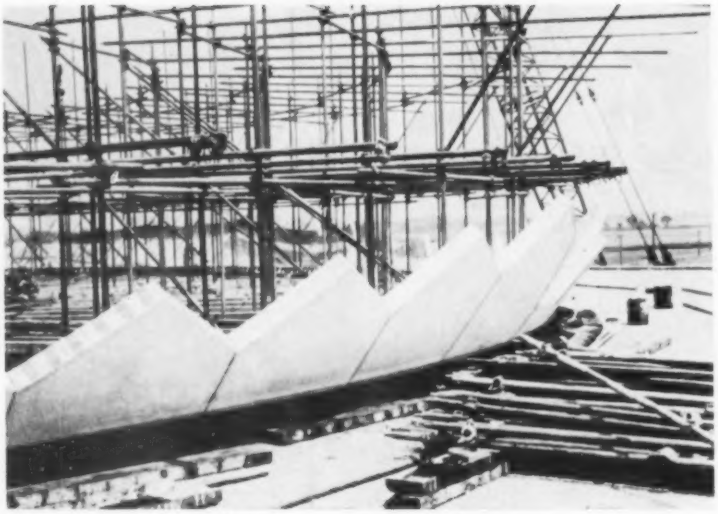


FIG. 6: Radome starts up as base ring of panels are fastened in place.

not packaged in special crates but were transported with padding between them to the loading platform, where they were individually loaded onto moving-van or furniture-type trailers. The panels were packed between pads and placed on edge in the moving van to minimize any abrasive action between them and the trailer elements. Standard trailers handled 52 and 65 panels per load.

At the storage site, individual panels were placed on racks that were separated and catalogued by panel style and number. These racks supported the panels in a nearly vertical plane and off the ground to prevent dirt and water damage. This storage location was close to the erection site to permit the crane boom to reach both the storage area and the radome erection area from one position. Before erection was started, all base panels and approximately 300 of the other standard panels (which represented about 25% of the total number of panels required) were in the storage area. An arrangement of 33 separate tiers or rows of panels was used in the erection sequence. The erection procedure shows the specific panels required for each tier and was, therefore, used as a guide for the order of panel fabrication and delivery, as well as to determine the earliest time that erection could start without interruption because of panel supply.

Erection procedure

Base-ring preparation. The radome was installed on the roof of a building 150 by 150 ft. sq. and 37 ft. high. The building supported a formed box steel ring 106 ft. in diam. and extending approximately 6 in. above the surface of the roof. This box steel ring, constituting the radome mounting ring, rested on the roof beams and trusses and was designed to distribute the load from the radome to the columns of the building. Preparation included the layout and drilling of 1270 attachment holes in the mounting ring, checking of the level of the attachment plane, and the necessary corrections that had to be made to bring the structure to acceptable tolerance.

Radome erection. Panels were lifted to the roof and subsequently raised by large cranes into position for placement. The radome was attached to the mounting ring by means of 0.750-in. diam., high-strength-steel bolts. (Fig. 5, p. 113). Reason why such a strong attachment is necessary is that during a 130-m.p.h. wind the radome assembly has a net aerodynamic lift of approximately 400.000 pounds.

The panels were located and loosely fastened for optimum adjustment before all bolts in the base were tightened. The installation of base panels progressed around the ring until all panels were in place (Fig. 6, above). Then the bolts between panels and the mounting ring bolts were tightened. Panels were hoisted from the ground storage to the roof storage to speed erection and taken as needed to form the successive tiers as the radome

FIG. 7: Half way complete. Rate of progress was limited not by speed of fastening panels but by rate at which scaffolding could be extended.

a substantial reduction in scaf-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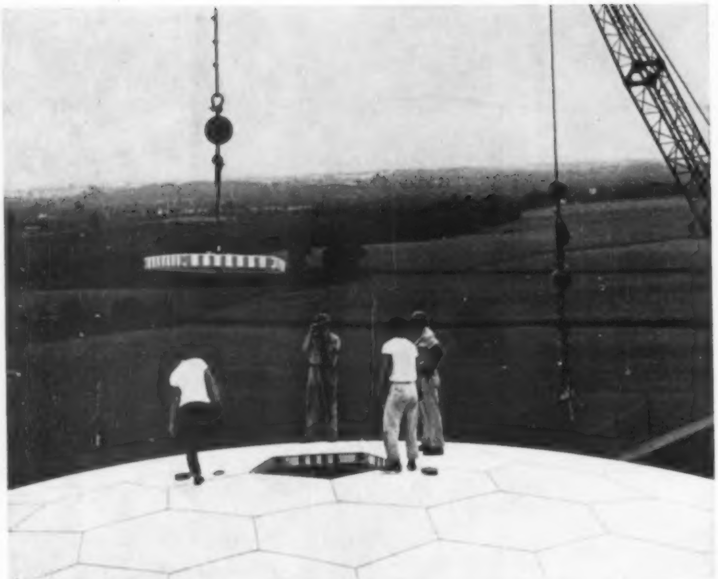


FIG. 8: Finishing touch. Final panel fits snuggly into place indicating the precision of the planning and prefabrication procedures.

progressed upward (Fig. 7, p. 114). The panels were hoisted by means of specially designed fittings that went into the connecting bolt holes in thin edges. Panels were bolted together by means of special right-angle-drive electric nut runners and special holding wrenches. The vinyl tape was removed from holes as necessary during erection. Whenever a panel was placed in position, the corner bolts were inserted and fastened first to pull the panel correctly into position. As panels were put into position above the base, it was essential that scaffolding be erected for working platforms during erection. Approximately every third tier of panels in the vicinity of the equator was stabilized by the use of cables extending from the panel to a center steel ring and tensioned to 1000 pounds. Thus, the open edge of the open sphere was stiffened to resist high winds during the time it was being erected.

As erection progressed, it was apparent that scaffold erection basically controlled the progress of panel placement. Every possible preparation and arrangement of materials for the subsequent lift was completed during the periods of delay for scaffold erection. As the crews became proficient, they were able to place more than 140 panels in a 10-hr. day. Under severe conditions or in short-season areas, a 24-hr. program could be established to permit erection to go at a much accelerated pace. As the radome approached closure, it progressed very rapidly, since the number of panels per tier or row was constantly being reduced. To provide a sealant against water, a strip of caulking compound was placed on each surface of the panels already installed near the outer edge of the channel and then the new panel brought down into place, squeezing the sealing compound between them for water seal. Sealing compound was also required on the inside of the rows of panels up to the equator because of the weather conditions during erection and previous to the covering of this portion of the panels. The last or top panel was a pentagonal panel having special pulley fittings, lightning rod, and navigation light hardware installed in it. This last panel went into place very snuggly and produced fit comparable with any of the other 1645 panels, as Figure 8, above, shows. The radome was erected, on schedule, in 21 working days. It is estimated for future emplacement that 15 working days on a 10-hr. shift would be ample and that a substantial reduction in scaffolding requirements could be made after evaluation of the experience gained during this prototype erection.

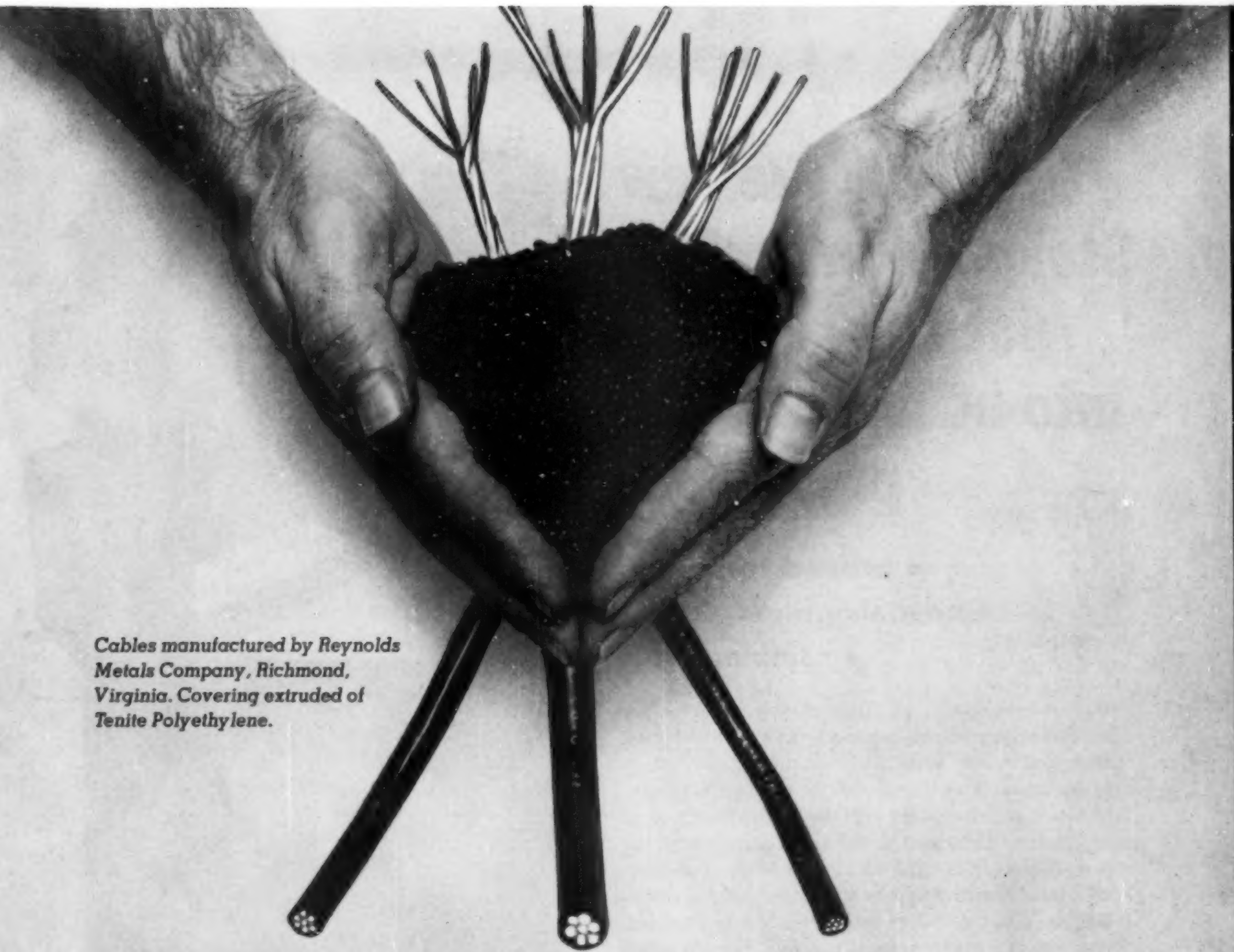
After the radome was completely erected all joints on the outside were caulked with sealing compound by pressing this sealing tape into the chambered joints from the top down to the equator. This caulking has provided a water-tight radome during the rains that it has encountered since erection. Panels were removed from one area near the base of the radome to form an 18-ft.-high by 20-ft.-wide opening for access to the interior for the removal of scaffolding and the installation of radar pedestal and antenna components. A temporary framework and doors were installed in this area. Other panels were removed near the base to allow a passage for the legs of stiff-leg derrick, which was erected inside the radome during antenna erection. As predicted, it was found that panels can be removed individually and that they can be replaced at any point in the radome.

During and after erection, panels that had been damaged from falling objects were repaired by use of field repair procedures and the kit provided for that purpose. Only two panels were damaged beyond repair and these were replaced from the spare-panels supply on the site.

Conclusion

Only nine months passed from the contract authority to the completely erected radome. The proposal was made in October 1958. The release for design came on November 8, 1959. The basic panel mold tooling was first ordered in December 1958. The designs were released for the necessary work the end of January 1959. The first tools were received in February and tried out in March.

By April several tools were in operation and in May all tools necessary to make the different panels were in use. In June and July, peak production was reached and the last panels were shipped during the month of August. The erection was completed on August 27, 1959.—**End**



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How to determine material cost

In many plastic processes where profits are in the order of a few cents per pound of product, a highly accurate cost estimate is needed to properly evaluate the profitability of a proposed operation. This article presents an analysis of material cost to demonstrate the dependence of material cost on processing conditions. A simple equation is developed that can be used as a tool to accurately estimate this cost of material in preparing unit cost estimates, provided certain processing conditions can be estimated.

Often, when estimating the unit cost of a plastic product, charges for material are determined by calculating the weight of the part and then multiplying this weight by the unit cost of the raw material to be used. This method results in an accurate material cost only if no losses occur in the process and only if we are able to recycle all the scrap. Sometimes the procedure is refined by throwing in a "fudge factor" to recognize that losses and scrap usually do occur. Many times this factor is based on average experience and may result in an erroneous cost estimate if the specific product that is under consideration deviates considerably from the average.

The error can be further compounded in cases where, for quality reasons, there is a limit on the amount of scrap that can be recycled. Heat sensitive materials are a typical example. In such cases, the manner in which the resultant excess scrap is disposed of will play a large part in determining the actual cost to be changed for material.

This article presents a rigorous analysis of the factors governing material cost. The result of this analysis is a relatively simple equation that describes the dependence of material costs on process conditions.

The material cost equation

To begin the analysis, the movement of material in almost all plastic fabricating processes can be described by the generalized flow sheet shown in Fig. 1, below. For example, in injection molding, losses occur due to spillage, loss of volatiles, etc., and scrap is generated in the form of sprues, runners, and rejects. In extrusion, in addition to the above, scrap also arises from trim and rejection of finished rolls.

Using the flow sheet shown in Fig. 1, the total feed to the process, T lb./hr., will be assumed to consist of a mixture of virgin material, F lb./hr., and recycled scrap, R lb./hr. A recycle rate, r, will be defined as the fraction of recycled scrap in the total feed

$$r = \frac{R}{F + R} \qquad \text{Eq. 1}$$

In the process it will be assumed that an amount of material, L lb./hr., is irrevocably lost and a loss rate, l, will be defined in terms of the total feed T, or F+R, as follows:

$$l = \frac{L}{F + R} \qquad \text{Eq. 2}$$

Similarly, it will be assumed that S lb./hr. of scrap is generated; the scrap rate s is defined by the equation:

$$s = \frac{S}{F + R} \qquad \text{Eq. 3}$$

In this generalized process it will further be assumed that P

NOMENCLATURE

- **F** = Virgin material feed, lb./hr.
- **R** = Recycled scrap, lb./hr.
- **S** = Scrap produced, lb./hr.
- **L** = Material irrevocably lost, lb./hr.
- **P** = Salable product, lb./hr.
- **X** = Scrap sold, used in other processes, or inventoried at some value, lb./hr.
- **f** = Price of virgin material used, $/lb.
- **p** = Cost of material per unit of product, $/lb.
- **x** = Value of scrap, i. e., its sale price, the amount at which it is charged to another process, or the arbitrary value at which it is inventoried, $/lb.
- **l** = Loss rate expressed as a fraction of the total feed, L/T.
- **r** = Recycle rate expressed as a fraction of the total feed, R/T.
- **T** = Total feed, i. e., F plus R, lb./hr.
- **s** = Scrap rate expressed as a fraction of the total feed, S/T.

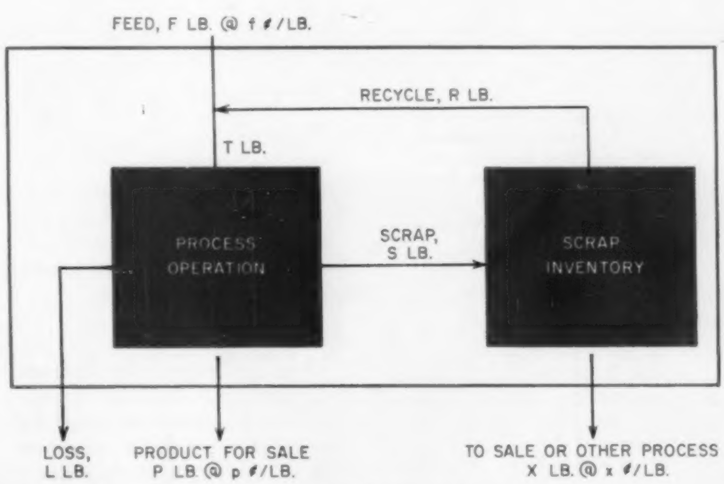


FIG. 1: Generalized flow diagram applicable to most plastic processes. Blue border indicates overall material balance system.

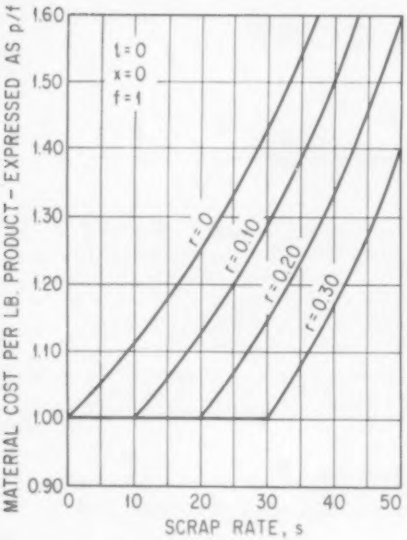


FIG. 2: Graphical presentation of Equation 12, below, showing how material cost varies with scrap as well as recycle rates.

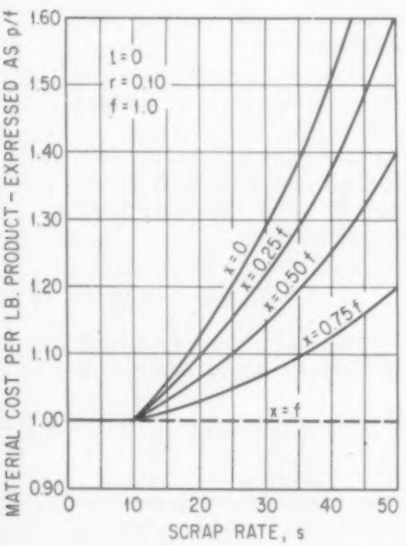


FIG. 3: Graphical presentation of Equation 12, which is shown at right, showing how material cost varies with scrap rate and the price received on the sale of excess scrap, other conditions as indicated.

lb./hr. of product is produced with a unit cost for material p \$/lb. of product, and an amount of scrap, X lb./hr., is produced in excess of the amount that is recycled, that is

$$S = R + X \qquad \text{Eq. 4}$$

This scrap is either inventoried, sold, or used in some other process in the plant. The excess scrap X, when used, is valued at x \$/lb.

By a material balance around the entire process (see Fig. 1.)

$$P = F - L - X \qquad \text{Eq. 5}$$

Using the relationship in Eq. 4 and substituting for X

$$P = F - L - S + R \qquad \text{Eq. 6}$$

Using Eqs. 1, 2, and 3

$$P = F - l\,(F + R) - s\,(F + R) + \frac{rF}{1 - r} \qquad \text{Eq. 7}$$

Expanding and further substituting for R we get

$$P = F - lF - \frac{lrF}{(1 - r)} - sF - \frac{srF}{(1 - r)} + \frac{rF}{(1 - r)} \qquad \text{Eq. 8}$$

which reduces to

$$P = \frac{F\,(1 - s - l)}{(1 - r)} \qquad \text{Eq. 9}$$

By a cost balance around the entire process

$$Pp = Ff - Xx \qquad \text{Eq. 10}$$

where f is the unit price of virgin raw material. Note that the losses are not considered. A little thought will make it obvious that the total material cost must either be charged to the product or to the amount recovered in the value received for the scrap.

Dividing Eq. 10 by Eq. 9 gives us the actual material cost per pound of product or

$$p = \frac{f\,(1 - r)}{1 - s - l} - \frac{X}{P}\,x \qquad \text{Eq. 11}$$

Using Eqs. 1, 2, 3, and 4 this can also be stated as

$$p = \frac{f\,(1 - r) - (s - r)\,x}{(1 - s - l)} \qquad \text{Eq. 12}$$

This equation allows a complete evaluation of all the variables that affect material cost and can be used to calculate exact material costs within the known accuracy of the variables.

Using the equation

Certain rules must be observed in applying the equation. For example, the values substituted for the variables must be consistent with each other. Thus, r can never exceed s, since this would imply that the amount of scrap being recycled exceeds the amount of scrap generated, which is not possible. If an outside source of scrap is available which allows us to feed more scrap than we generate, then the combination of outside scrap and virgin material must be considered as a new virgin feed with a different average initial price f'.

To illustrate the use of the equation, the following specific cases are considered.

Case I: Assume the process is ideal with no losses or scrap production. In this case Eq. 12 reduces to

$$p = f \qquad \text{Eq. 13}$$

which is exactly what would be expected in such a process.

Case II: In this case, the same conditions as in Case I are assumed with the exception that losses to the extent of l of the total feed are incurred, then

$$p = \frac{f}{1 - l} \qquad \text{Eq. 14}$$

and material costs will vary according to the amount of unrecoverable loss incurred.

Case III: Assume the same conditions in Case II with the exception that in addition to the losses, scrap to the extent of s of the total feed is generated and entirely recycled. Then Eq. 12 can be simplified to

$$p = \frac{f\,(1 - s)}{1 - s - l} \qquad \text{Eq. 15}$$

or

$$p = \frac{f}{1 - \dfrac{l}{1 - s}} \qquad \text{Eq. 16}$$

Although all the scrap is recycled, the increase in material cost is further inflated since the amount of material cycling in the process has increased.

Since it was assumed that losses were proportional to the total feed, the absolute amount of losses per pound of product produced has increased, thus further increasing the cost.

Case IV: Assume the same conditions as in Case III except that only one half the scrap can be recycled. It is further assumed that the excess scrap cannot be used or sold. Since the value of

scrap which cannot or will not be used is obviously zero

$$\frac{s - r}{(1 - s - l)}\, x = 0 \qquad \text{Eq. 17}$$

and Eq. 12 becomes

$$p = \frac{f\left(1 - \frac{s}{2}\right)}{1 - s - l} \qquad \text{Eq. 18}$$

Case V: Finally, assuming that the excess scrap generated in Case IV is sold or used at some value x, then Eq. 12 becomes

$$p = \frac{f\left(1 - \frac{s}{2}\right)}{1 - s - l} - \frac{\left(\frac{s}{2}\right) x}{1 - s - l} \qquad \text{Eq. 19}$$

or

$$p = \frac{f\left(1 - \frac{s}{2}\right) - x\left(\frac{s}{2}\right)}{1 - s - l} \qquad \text{Eq. 20}$$

In this case our material cost is reduced by

$$\frac{s\, x}{2\,(1 - s - l)} \qquad \text{Eq. 21}$$

If $x = f$, this has the same effect on material cost as the recycling of all the scrap would have since Eq. 20 reduces to Eq. 16.

The general equation is plotted in Figs. 2, 3, and 4. Figure 2, p. 120, illustrates the effects of scrap rate and recycle rate on material cost, assuming no losses occur and excess scrap is inventoried at zero value. Note that with no losses, no inflation of material cost occurs until the scrap rate exceeds the recycle rate. Once the scrap rate exceeds the permissible recycle rate cost rises rapidly.

Figure 3, p. 120, illustrates the effect of selling the excess scrap (which is not recycled), on material cost at various scrap rates. As the value received for this scrap approaches the price of the virgin material the material cost per unit product becomes identical with the price paid for the virgin material. Although this does not affect our material cost, the scrap rate can still be very high and other production costs will be affected, since the material is being very inefficiently handled, and production rates are lower than if we ran no scrap.

Figure 4, above, shows the compounding effect scrap has on the increase in material cost when both losses and scrap are generated. Note when $r = s$ and $l = 0$, $p = f$. If only losses occur without the production of any scrap, i. e., $s = 0$ and $l = 0.05$, material cost varies only with l. When both scrap and losses occur, and it is possible to recycle all the scrap, the increased amount of material circulating in the process increases the losses above what would be experienced if only losses took place. The net effect of losses being present with scrap moves the curves shown in Fig. 2 up and causes the cost of material to rise slightly more steeply.

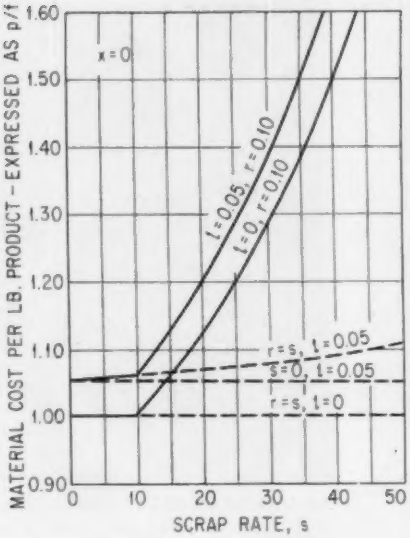


FIG. 4: Graphical presentation of Equation 12, p. 120, showing how material cost varies with scrap rate when losses are also incurred; other conditions as indicated.

Scrap

The rate of scrap generation and the value at which it is disposed of are the chief factors in determining material cost (other than the initial price paid for the virgin raw material). Losses are not considered a major factor, since they generally are small (only a few percent of feed).

How much is scrap worth? In the case of outside sale of scrap, this is not a problem since the value is fixed by the price we receive. Similarly if the scrap is being used in another process where we would have to buy material at a given price, the scrap has a value equal to the price we would have to pay for new material. In both cases, the value of the scrap is determined by the manner in which it was used.

When scrap is not used, it is occasionally placed in inventory. Sometimes it is given an arbitrary inventory value since some people seem reluctant to write it off to zero value. If scrap to be inventoried is given an arbitrary value, the net effect is a reduction in the cost to be charged to the product. However the amount of the cost reduction is merely transferred to an inventory where it becomes a deferred charge. This results in an overstatement of profit on the product being produced in the current period, because of the apparent reduced production cost. If production volume is substantial, this might result in a significant tax loss which may not be recoverable.

If profits are to be stated accurately, and it is reasonable to assume that the scrap produced at a known value in any given period will not be used, scrap going into inventory should be considered of no value for cost estimation.

In order to give a practical example of how the equation may be applied, consider the extrusion of polyethylene film. Assume the virgin material cost is 32.5¢/lb., that losses are 2% of material fed to the extruder, trim scrap is 10% and the rejection of rolls due to gage is 5% of the material fed to the process. Assume 10% of the feed to the extruder can be scrap (i. e., trim is recycled at machine). Assume the rejected rolls are chopped up and sold as scrap for 15¢/lb. Then using Eq. 12

$$p = \frac{f\,(1 - r) - (s - r)\,x}{1 - s - l}$$

$$p = \frac{(32.5)\,(0.9) - (0.15 - 0.10)\,15}{0.83}$$

$p = 34.34$¢/lb.

This is the amount that should be charged for material in estimating the unit cost of the film under these processing conditions.

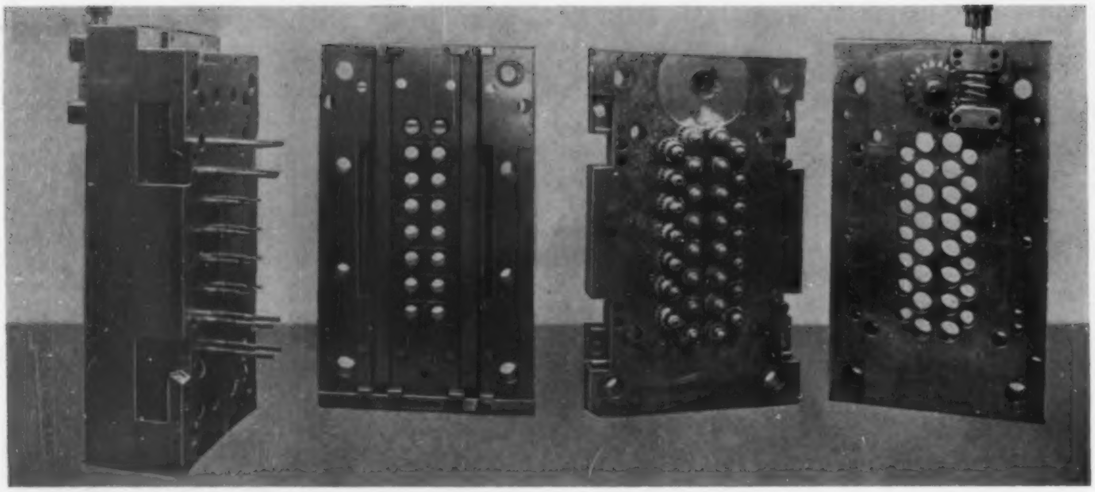
If the scrap cannot be sold and cannot be recycled then

$$p = \frac{(32.5)\,(0.9)}{0.83}$$

or

$$p = 35.24\text{¢/lb.}$$

resulting in a 0.9¢/lb. increase in material cost charged to the product.—*G.R.S.*



AN UNSCREWING-TYPE MOLD for the production of threaded pen parts. Because of precision used in construction, the entire gear train can be turned by hand using the motor coupling (upper right).

A new approach to precision molding

Careful attention to mold design details are an essential requisite in running the tough jobs successfully

By O. A. Westgaard*

As a custom molder, you have, undoubtedly, had your share of running "dogs"—tough molding jobs which, from the profit standpoint, you wish you had never attempted. With the trend toward captive molding, easy jobs may be hard to find. They'll be molded in integrated operations. We may find that our chief asset will be our ability to handle the impossible jobs profitably.

What are these tough jobs that we are talking about? One category is small, high precision parts with "impossible" tolerances, such as are found in some of our newer electronic and space age equipment. Another is that family of parts which, because of their design, entail complex molds with long delicate pins, and unscrewing or other devices to handle internal and external threads or other complexities of design. Finally, we may also be faced with the challenge of new materials.

Can these problems be solved; can these jobs be run at a profit to the custom molder? The answer is decidedly yes. As a matter of fact, some molders specialize in this kind of molding and we cannot complain about the living that we make at it.

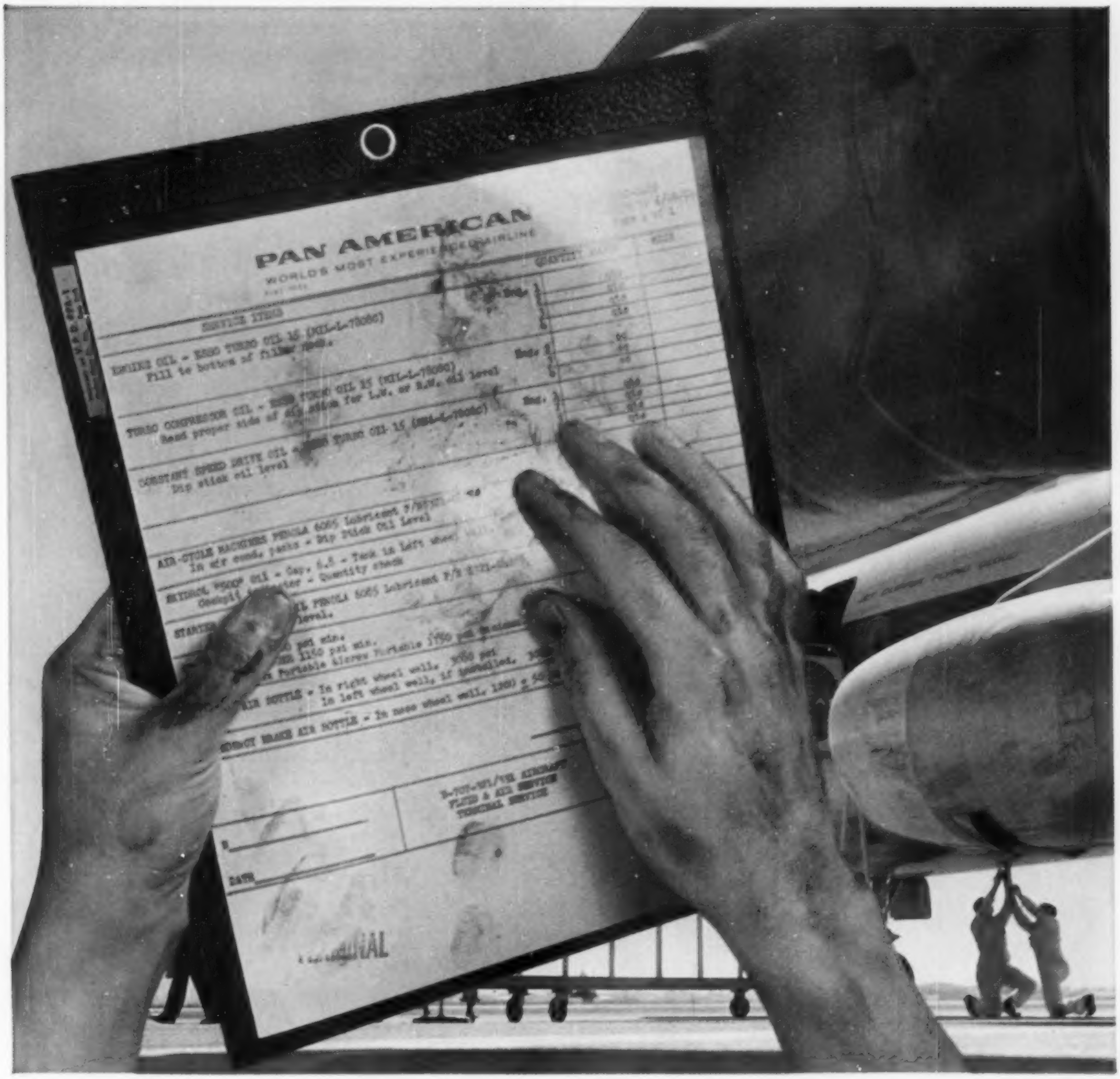
But, and this is a big but, we do not mean to imply that the problems are solved by the routine approach to injection molding that many processors are accustomed to in the industry. Special problems require special attention to get satisfactory solutions and profitable operations.

Mold design crucial

Experience has often demonstrated that many of the problems arising in the molding of small dimensioned parts (where tolerances must be tight) stem from poor attention to the precision required in building the mold. Many articles have been published on the need for high precision in mold making, yet many molders will accept dies which are designed more from the standpoint of the moldmaker's convenience rather than from the requirements of the job. Sometimes the molder is trapped into the false economy of skimping on the cost of the mold and is hopelessly stuck when he tries to run the mold and hold tight tolerances.

Often because there isn't enough trouble taken in trying to accurately calculate the stresses under which a mold will operate, molds are built oversize with tremendous unneeded safety factors. Molds are often much larger than they need be and they must be run in a larger machine than is needed for the shot weight. Result: higher fixed costs on mold and machine. A good example of what can be done with the proper attention to detail was a redesigned 16-cavity pen barrel mold for our own use in a 3-oz. machine. This mold ran on the same cycle that was used on a mold *twice* its size, which was made by the usual moldmaker, with only 12 cavities and requiring a 6-oz. machine. Four more

* President, G-W Plastic Engineers Inc., Bethel, Vt.



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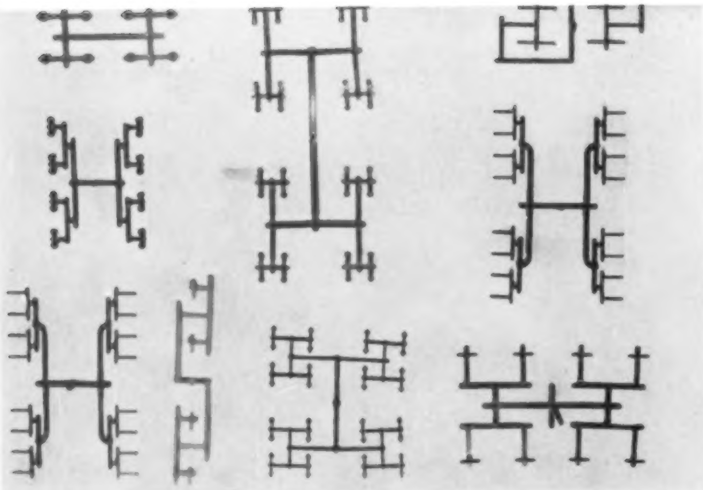


A GROUP of castings showing the off-beat runner layouts used to insure simultaneous fill of all cavities.

pen barrels per cycle; 25% reduction in unit cost.

Typical of this smaller mold design are the mold sets shown below. These sets also illustrate another mold construction technique we have successfully used. The sets shown are made to fit in a frame common to several other sets and molds are made on a modular basis. Using this type of construction, set-up and change-overs from one mold to another are greatly simplified, resulting in significant reductions in down time and press costs.

Design of runners

Obviously, runner layout and construction are also an important factor in successful mold designs and require more than just casual attention. Based on our experience, the crucial consideration here is getting the material to flow into each cavity simultaneously. This involves two things. First, laying out the runner system geometrically such that this occurs using the principles of successive simultaneity as they were first described in an article in MODERN PLASTICS (see October 1956, p. 166). Typical shots illustrating this principle are shown above.

Second, especial attention should be paid to the dimensions and surface finish of the runners and gates themselves. That is, all runner paths to all cavities should be identical in cross-section and length; the same for gates. Coring in the mold for cooling should provide for uniform temperatures in all runner paths, gates, and cavities as much as is practical.

This requires that special care be used in cutting the runner and gate systems in the mold to precise tolerances in the order of $\pm$ 0.0002 in.; not just "hogging" them out to provide an opening for material to pass through.

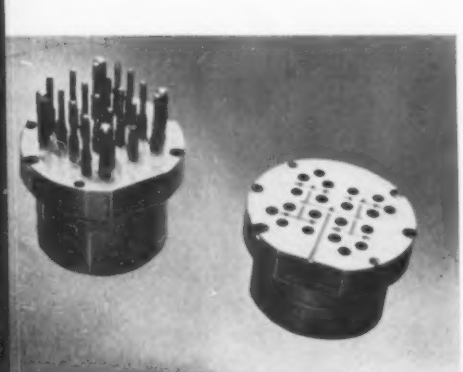
Realizing that in some cases it would be difficult to find mold makers willing to work to such precise tolerances, we have often had to design and supervise the construction and assembly of our own molds. In connection with this, we use the services of the mold maker for some parts; often we make our own parts; and sometimes we have had very good work done for us by high precision machine shops not ordinarily in the business of making molds such as the Pratt & Whitney Co. Inc. This often results in our getting mold components from several sources. However, since a close adherence to tolerances has been insisted upon, the molds have gone together like clockwork.

The photo on p. 124 illustrates the complexity of a mold for a threaded part that can be engineered and procured in this fashion. Because of the precision demanded of the components, the entire gear train of the unscrewing system shown can be turned by hand by rotating the motor coupling. This would be very difficult to do with a lesser degree of perfection in the mold.

What does all this minute attention to detail accomplish? Briefly, it often makes the "impossible" possible. For example, we once agreed to mold some small Kel-F parts in a multi-cavity mold using pin-point gates. We were warned it could not be done. Following the principles outlined above, we went ahead, built our molds carefully, and found the job could be done profitably.

The secret of making the molding of small parts profitable also requires the matching of the job to the proper size machine. Purposely we make our molds as small as we can to run in as small a machine as possible consistent with a given output. The shot size is made as large as possible within the capacity of the machine to utilize the equipment at its maximum efficiency. The lower capital investment in a small machine reduces the fixed charges per piece, results in a low manufacturing cost, and maximizes return on the investment.

Conclusions are: the molder need not scare easily when it comes to taking on a tough molding job—he can even specialize in these jobs—and do it profitably. But he must break with the tradition of trying to cut corners by producing cheap molds whose initial cost advantage is more than lost in barrels of rejects. In today's market the processor will find precision molds more profitable and less nerve racking to operate—in tomorrow's market they may make the difference between staying in business profitably or folding.—**End**



SIXTEEN-CAVITY mold for the pen barrels. Mold sets shown here are modular units which fit into universal mold frame. The system facilitates mold changes as well as set-ups.

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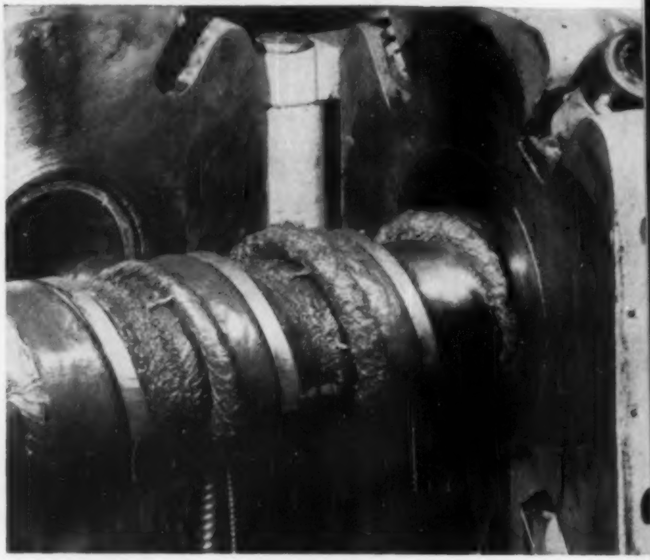
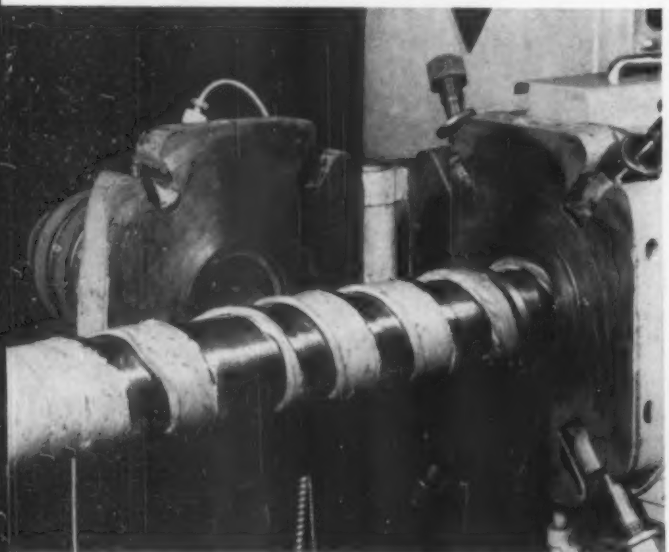
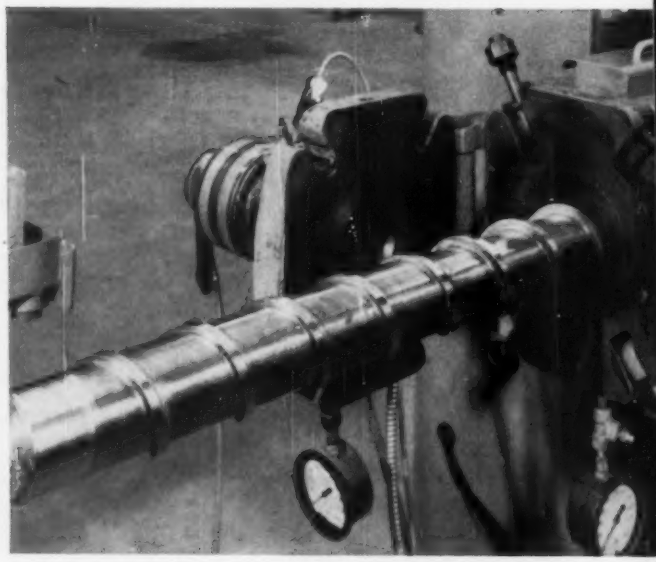


2. Operate machine to purge old material.



3. Note how A-C Cleaning Compound strips off easily.



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PLASTICS* **TECHNICAL SECTION**

MATERIALS • PROPERTIES • TESTING METHODS AND INSTRUMENTATION • STANDARDS • CHEMISTRY

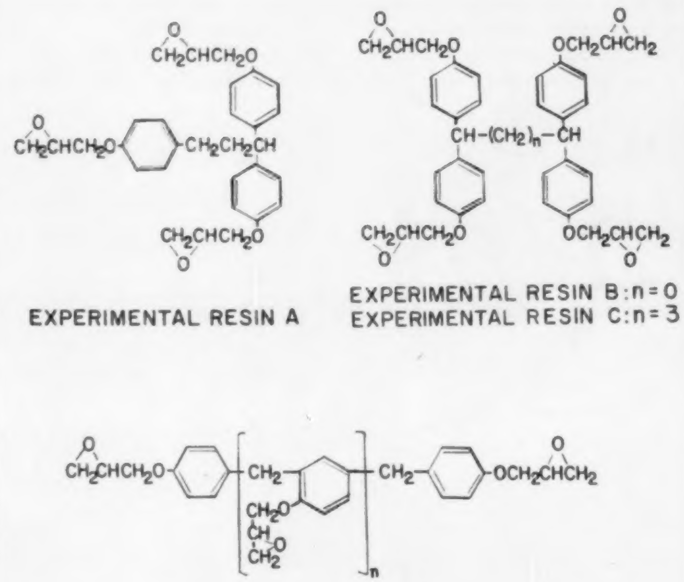
Structure versus elevated temperature performance of epoxy resins

By J. Wynstra†, A. G. Farnham†, N. H. Reinking†, and J. S. Fry†

The epoxy resins based on bisphenol-A and epichlorohydrin have generally not been recommended for structural plastics applications where service temperatures above 300° F. are to be encountered. Although numerous differences in heat distortion temperature are, of course, to be found in different hardener as well as catalyst formulations, performance above the indicated temperature limit has been found only rarely.

In general, the heat distortion temperatures one can expect from the diglycidyl ether resins cured with the commonly used polyamine or anhydride hardeners are such that structural plastics formulated from them would not be expected to have any strength values of practical interest at temperatures as high as 400 or 500° F. One exception to this generalization and a close approach to true high temperature performance from present-day commercial epoxy resins is to be found in the use of pyromellitic dianhydride as a hardener (1)[1]; application problems associated with the high melting point and limited solubility of this compound, however, have made it difficult to realize the full potential of this system.

In the case of the more common polyamine hardeners for epoxy resins, it has been reported that increasing the functionality of the hardener beyond a rather modest value has but little effect on the observed heat distortion temperature (2). Instead it was found that the calculated functionality (3) of the epoxy resin-hardener system gave a truer indication of the performance of the cured polymer. According to this concept, regardless of the functionality of the



EXPERIMENTAL RESIN A

EXPERIMENTAL RESIN B: n = 0
EXPERIMENTAL RESIN C: n = 3

EXPERIMENTAL RESIN D: n = ~1
EXPERIMENTAL RESIN E: n = ~2
EXPERIMENTAL RESIN F: n = ~3
EXPERIMENTAL RESIN G: n = ~4

FIG. 1: Idealized structures of some higher functional epoxy resins.

* Reg. U. S. Pat. Off.
† Research Dept., Union Carbide Plastics Co., Div. of Union Carbide Corp.
[1] Numbers in parentheses link to references at end of article, p. 190.
Based on a paper presented at the Epoxy Resin Symposium of the American Chemical Society's Division of Paint, Plastics, and Printing Ink Chemistry, Sept. 1959.

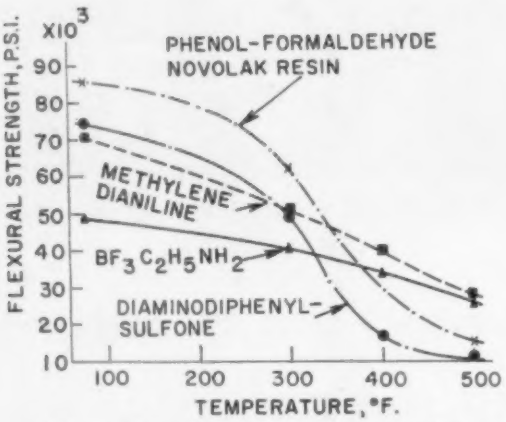


FIG. 2: Flexural strength versus temperature of glass cloth/Resin A laminates using different types of curing mechanisms.

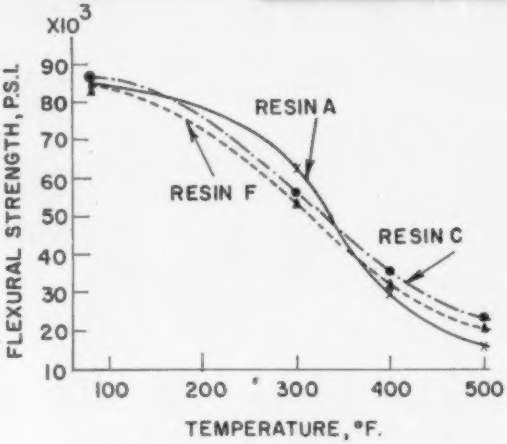


FIG. 3: Flexural strength versus temperature of glass cloth laminates prepared from different polyglycidyl ether resins hardened with an equivalent amount of a phenol-formaldehyde novolak resin and a tertiary amine catalyst.

hardener, a diepoxide would impose an upper functionality limit of 4 on the system if the epoxide group were monofunctional in the curing process.

As a corollary to this, it can be inferred that, if epoxy resins and the more common types of hardeners are to be used in applications involving higher service temperatures, a resin with a functionality greater than that of the bisphenol - epichlorohydrin type will have to be used. Some evidence that even rather modest increases in functionality raise the service temperature limit significantly has been reported in the performance of the mixtures of glycidyl ethers having an average functionality of 2.6 and 3.2, derived from low molecular weight phenolformaldehyde novolak resins (4, 5).

To learn something of the utility of still higher functional epoxy resins, some tri-, tetra-, and higher glycidyl ethers were prepared from epichlorohydrin and appropriate polyphenols. These products, the idealized structures of which are shown in the formulas in Fig. 1, p. 131, were used to impregnate glass cloth and the resulting laminates were evaluated as higher service temperature structural plastics.

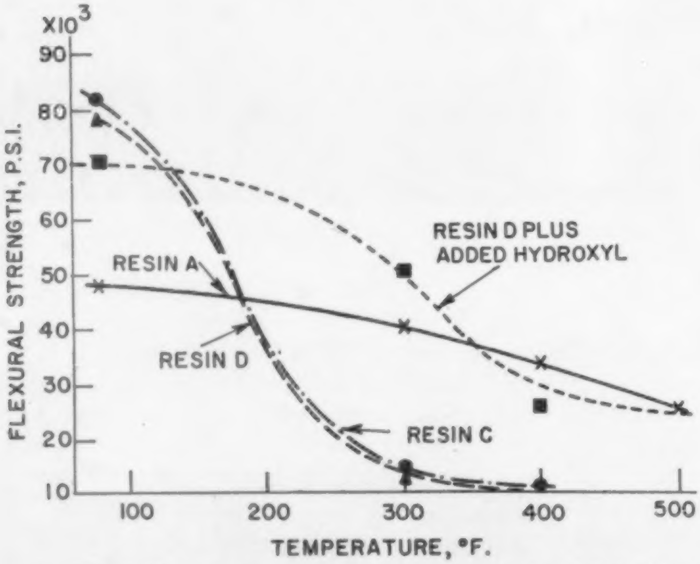


FIG. 4: Flexural strength versus temperature of glass cloth laminates prepared from different polyglycidyl ether resins that were self-condensed with four parts of boron fluoride-ethylamine complex per 100 parts of epoxy resin solids.

Preparation of resins

Resin A: The trisphenol, 1,1,3-tris - (hydroxyphenyl) propane, was made by condensing a large excess of phenol (10 moles) with acrolein (1 mole) using hydrochloric acid (0.05%) as a catalyst (6). Because the condensation was rapid and exothermic, it was found advisable to add the acrolein to the phenol plus acid catalyst at such a rate that a temperature of 50° C. could be maintained; after all of the acrolein had been added, it was only necessary to heat to 100° C. to complete the condensation. The trisphenol was obtained as a residue product after stripping off water and excess phenol and after a brief steam distillation. That the product obtained was a mixture of isomers was suggested by its physical form, a hard glossy solid which did not crystallize. Hydroxyl and molecular weight analysis supported the assumption, however, that the principal component was the trisphenol having the empirical formula $C_{21}H_{20}O_3$:

Hydroxyl content by acetylation: 15.5%; theory, 15.93%. Menzies - Wright molecular weight: 380-420; theory, 320.37.

By analogy to the effect of mineral acids in promoting para-substitution in phenol-formaldehyde condensations (7, 8), it was

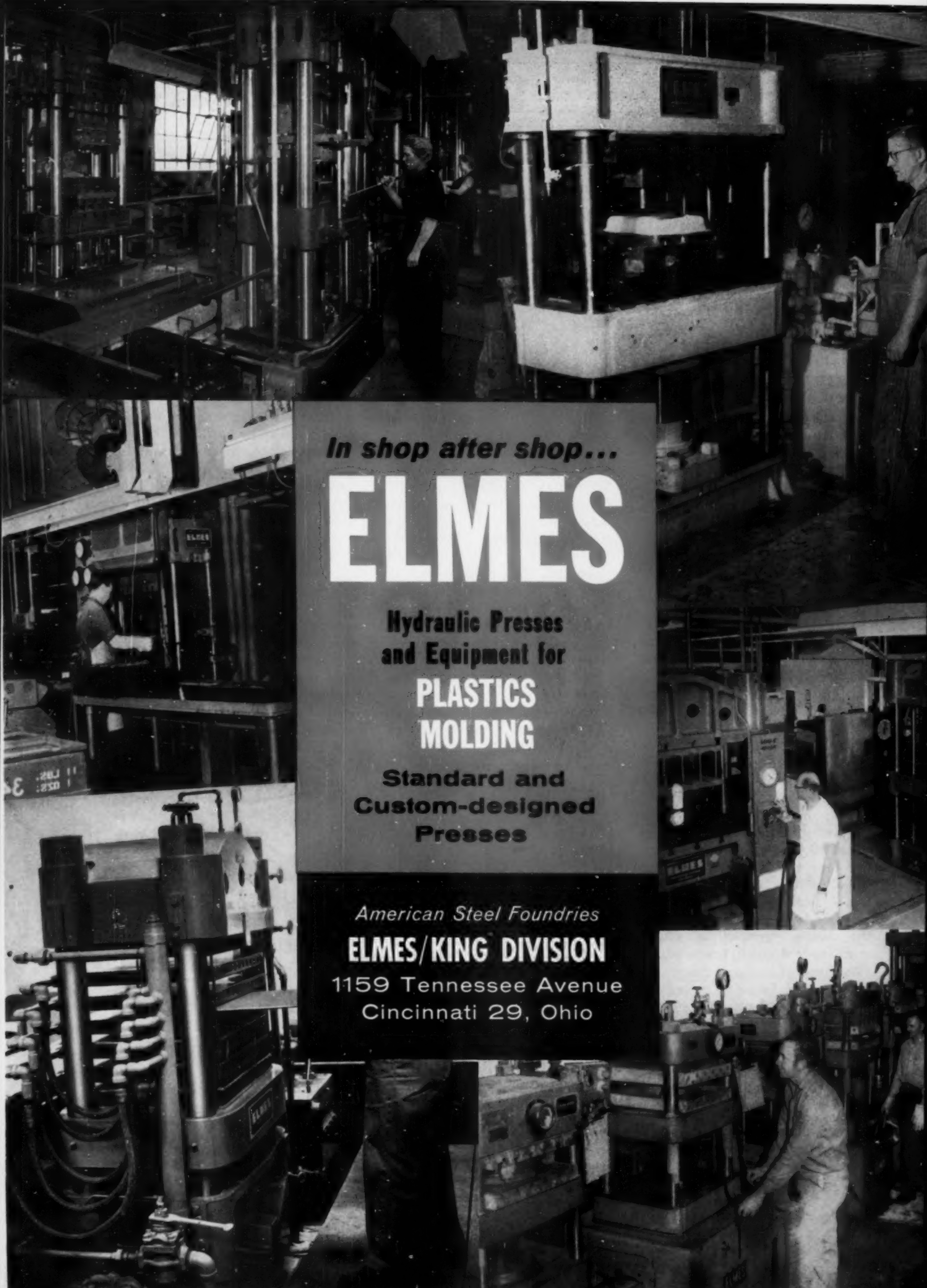

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Table I: Preparation of glass cloth laminates from Resin A and different hardener or catalyst combinations

Hardener or catalyst used with Resin A		Amount of resin in laminate	Cure cycle	Postcure
	PHR[a]	%	°C/hr./p.s.i.	°C/hr.
4,4'-Methylene dianiline	27.5	33-35	160/1/300	205/6
Diaminodiphenylsulfone	34.5	33-38	160/1/400	205/6
Novolak resin[b]	58.	33	160/0.5/400	205/6
$BF_3.C_2H_5NH_2$	4.0	32	160/0.5/400	205/6

[a] Parts per hundred of epoxy resin solids.
[b] Catalyzed with 0.1% (based on weight of epoxy plus phenol resin solids) of alpha-methyl-benzyl dimethylamine.

guessed that the most likely isomer of 1,1,3-tris(hydroxyphenyl)propane would be the one indicated by the idealized structural formula of Fig. 1.

A typical laboratory scale glycidyl ether preparation consisted of the following charge:

330 g. 1,1,3-tris(hydroxyphenyl)propane
832 g. epichlorohydrin (200% excess)
232 g. 95% ethanol
264 g. 50% sodium hydroxide (110% of theory).

The method followed was similar to one that can be used to prepare a liquid epoxy resin from bisphenol A (9) and consisted of the initially slow (and then accelerated, according to the exothermicity of the process) addition of the alkali solution to the epichlorohydrintrisphenol-alcohol solution maintained at 60° C.

The complete alkali addition usually required about 90 min.; by-product brine was removed by decantation and the glycidyl ether was recovered as a residue product after vacuum-stripping to remove alcohol and excess epichlorohydrin. For convenience, the residue product, a sticky semi-solid at room temperature, was handled as a solution in toluene. The following properties found for one batch of the glycidyl ether-toluene solution are considered typical:

Non-volatile content: 62.4%
Viscosity: 65 centistokes, at 25° C.
Epoxy equivalent: 180 on 100% solids basis
Hydrolyzable chlorine: 0.14% on 100% solids basis

Resins B and C: The parent tetraphenols, from the reaction of phenol with glyoxal and glutaraldehyde, respectively, were made by hydrochloric-acid-catalyzed condensations. A large excess of phenol was used in each case to minimize higher polymer formation; the general procedure and the results obtained were quite similar to those described above in the case of the trisphenol. Essentially the same epichlorohydrin reaction technique was used to prepare the glycidyl ethers of these tetraphenols; as in the case of Resin A, these glycidyl ethers were also semi-solids which were more conveniently handled as solutions in toluene.

Resins D, E, F, and G: These polyphenols were made from empirical ratios of phenol and formaldehyde with hydrochloric acid as a condensation catalyst. The approximate average degrees of polymerization of the products were deduced from Menzies-Wright molecular weight determinations; in each case, it was found necessary to start with a slightly greater proportion of phenol to formaldehyde than calculated to achieve the molecular weight wanted. The same general procedure of glycidyl ether preparation was again followed in each of these cases; for convenience these resins were also dissolved in toluene for use.

Preparation of laminates

Glass cloth (#181 weave, Volan A finish) was impregnated with various resin-hardener and resin-catalyst combinations from solution using a conventional dip roll and doctor bar apparatus, the resin being advanced on the cloth to a "B-stage" by heat. The resin solutions, for the most part using toluene-ethanol as a mixed solvent, were adjusted empirically to preload the cloth to a desired 30 to 35% resin content. Laminates ⅛ in. thick were pressed to stops from crossed plies of treated fabric; curing varied somewhat with different systems, but a 60-min. cycle at 160° C. and 1000 p.s.i. pressure followed by a 6-hr. postcure at 205° C. is typical.

Some of the experimental resins were evaluated in a number of hardener or catalyst formulations; flexural strengths at different temperatures and weight losses on heat-aging were used as principal indications of potential usefulness at elevated temperatures. Each of the experimental resins

Table II: Properties of glass cloth laminates made with Resin A cured with a stoichiometric quantity of phenol-formaldehyde novolak resin and with boron fluoride—ethylamine catalyst

Property	Strength of Resin A laminate: Phenolic cured	Strength of Resin A laminate: BF_3-ethylamine cured
	p.s.i.	p.s.i.
Flexural strength at 77° F.	8.53×10^4	5.78×10^4
Flexural modulus at 77° F.	3.89×10^6	3.89×10^6
Flexural strength at 300° F.	6.30×10^4	4.93×10^4
Flexural modulus at 300° F.	3.13×10^6	2.98×10^6
Flexural strength at 400° F.	2.80×10^4	3.31×10^4
Flexural modulus at 400° F.	2.78×10^6	2.28×10^6
Flexural strength at 500° F.	1.69×10^4	2.57×10^4
Flexural modulus at 500° F.	1.64×10^6	2.33×10^6
Edgewise compressive strength at 77° F.	5.80×10^4	4.33×10^4
Compressive modulus at 77° F.	3.54×10^6	3.52×10^6
Tensile strength at 77° F.	4.90×10^4	3.44×10^4
Tensile modulus at 77° F.	2.79×10^6	2.72×10^6

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was also evaluated in the more interesting of these type formulations so that some conclusions might be drawn about the effect of structure of the epoxy resin on overall performance.

The pertinent details of formulation and curing of glass cloth laminates based on Resin A and different hardeners are shown in Table I, p. 134; the performance of these systems is shown graphically in Fig. 2, p. 132; and detailed property data for the more interesting systems are given in Table II, p. 134.

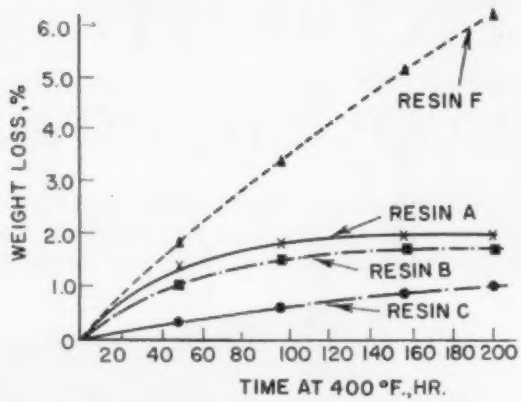


FIG. 5: Weight losses at 400° F. of glass cloth laminates prepared from different highly functional epoxy resins cured with an equivalent amount of a phenol-formaldehyde novolak resin and a tertiary amine catalyst.

Properties vs. resin system

The relatively poor performance of Resin A cured with the diaminodiphenylsulfone hardener indicated in Fig. 2 is probably indicative of undercuring; the better performance of methylene dianiline, on the other hand, was of limited interest because of the demonstrated poor thermal stability of amine-hardened epoxy resins(2) and also because of the poor "B-stage" treated-fabric shelf life of the Resin A/methylene dianiline combination.

The phenolic hardener and boron fluoride-amine complex-catalyzed systems were investigated further using the other experimental epoxy resins. In the phenolic hardener system, a calculated 1:1 ratio of phenolic hydroxyl to epoxide was employed in each case, as well as the tertiary amine catalysis and other curing conditions noted in Table I. The boron fluoride-amine complex concentration was fixed at 4.0% of the weight of epoxy resin solids. Figures 3 and 4, p. 132, summarize the performance of these laminates. It can be noted, for example, that the difference between a trifunctional and a tetrafunctional resin is of a relatively minor nature; also the difference between a "pure" polyglycidyl ether and the mixture derived from phenol-formaldehyde condensates is not great.

The rather poor performance of some of the resins cured with the boron fluoride-amine complex suggested that these compositions might have been under-cured. By analogy to the findings of model compound reaction studies(10) it was suspected that the addition of some hydroxylic compounds might enhance both the rate of this self-polymerization curing reaction and its degree of completeness. As Fig. 4 data indicates, this modification could upgrade the poorest performing hardener to something approaching that of the best of the series.

It has been reported that, in the bisphenol series of epoxy resins, phenolic hardeners yield condensates showing much lower weight losses on heat-aging than are found from the more common aliphatic or aromatic polyamine hardener systems(2). Figure 5, above, shows the weight loss data obtained from glass cloth laminates using phenolic (novolak) resin curing of several of the experimental resins described in this paper. In this test one of the tetrafunctional resins (C) was superior to the trifunctional (A) which, in turn, was greatly superior to a novolak-based pentafunctional epoxy resin (F).

A further measure of the thermal stability of these and other experimental systems was obtained by studying the high temperature flexural strengths of laminates as a function of heat aging. Figure 6, left, summarizes data showing that the 400° F. flexural strength of phenolic-cured Resin A (To page 190)

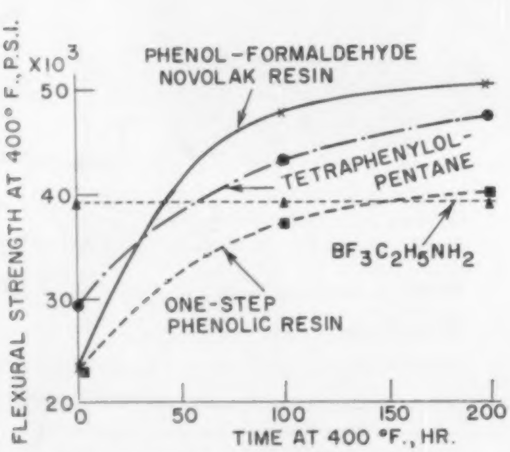


FIG. 6: Flexural strength at 400° F. versus time of aging at 400° F. of glass cloth laminates prepared from Resin A, curing by boron fluoride-amine catalysis and by stoichiometric hardening with the indicated phenolic compounds plus tertiary amine catalyst.

Estimation of long-time performance of extruded plastic pipe from short-time burst strength

By S. Goldfein*

This investigation was undertaken to develop a method for estimating the long-time strength of thermoplastic pipe by means of short-time burst strength tests. A parameter previously developed by integrating Arrhenius' law between limits and incorporating an expression for the kinetic order of the reaction was used. This general parameter was found to be applicable to all types of plastics. Four types of thermoplastic pipe were investigated: high-density polyethylene, acrylonitrile-butadiene-styrene, high-impact polyvinyl chloride, and normal-impact polyvinyl chloride. Master rupture curves were obtained by plotting short-term burst strengths versus the parameter. The master curves so obtained were then used to predict rupture properties for periods of time from 0.1 to 22,000 hours. Good accuracy was obtained by this method. It is concluded that the parameter

$$K = \frac{T_o T}{T_o - T}\ (20 + \log t)$$

where T_o = zero strength temperature, T = operating temperature, and t = time, may be used to estimate long-term operating pressures of thermoplastic pipe on the basis of burst strength data at elevated temperatures. The value of zero strength temperature may be determined from molding temperature data or extrapolation of strength-temperature curves, whichever is considered to be more feasible.

All plastics show a continuous flow under the influence of a constant stress. Elevated temperatures serve to accelerate this process. As a result, the mechanical properties of plastics are much more time and temperature dependent than the mechanical properties of metals; the same design criteria, therefore, do not hold for both materials. This is particularly true of pipe extruded from thermoplastic materials. As a result, research into the long-term behavior of plastic pipe has become a subject of increasing importance (1-3).[1]

The ideal solution would be a method of correlating short-term burst strength tests with long-term behavior. Much work has been done in the past (4-7) in correlating short-term static tests at elevated temperatures with long-term behavior of reinforced plastics. It was also found possible to do this for thermoplastic materials (8) by developing a generalized parameter:

$$K = \frac{T_o T}{T_o - T}\ (20 + \log t) \qquad \text{Eq. 1}$$

where T_o = zero strength temperature (°F. abs.), T = operating temperature (°F. abs.), and t = time under constant load (hr.). In developing this formula, the assumption was made that the process of creep in all plastics could be treated mathematically as a zero-order chemical reaction (8).

When the parameter is used, a master rupture curve is drawn with the ultimate rupture stress as the ordinate and the parameter K as the abscissa. Since the time t in Equation 1 represents the time during which the material is under a steady load rather than a gradually continuously increasing one, the time to ultimate failure measured during the static test cannot be used in the parameter without excessive error. Trial and error tests have indicated that the steady load time equivalent (SLTE) is approximately 10^{-5} hours. When a master rupture curve based on static tests is drawn, this value can be introduced for t in Eq. 1 for all values of T. The curve having been drawn, a knowledge of any two values of the three variables, time, temperature, and rupture stress, will allow the calculation of the third variable.

Test data

The burst strength test presently being used in most laboratories is A.S.T.M. D 1599-58T, "Tentative Method of Test for Short-Time Rupture Strength of Thermoplastic Pipe, Tubing, and Fittings." This test is performed in such a manner that there is a gradual and continuous build-up of hydrostatic pressure until failure occurs in a specimen with restrained ends. Since both static test and burst test are performed in the same (To page 142)

Table I: Materials from which pipes were extruded

Material	*Source*
Polyethylene (density 0.945)	Hercules Powder Co., Hi-Fax
Acrylonitrile-butadiene-styrene polymer (Type II)	Marbon Chemical Co., Cycolac C
Polyvinyl chloride (high impact, Type II)	B. F. Goodrich Chemical Co., Geon 8700A
Polyvinyl chloride (normal impact, Type I)	B. F. Goodrich Chemical Co., Geon 8750

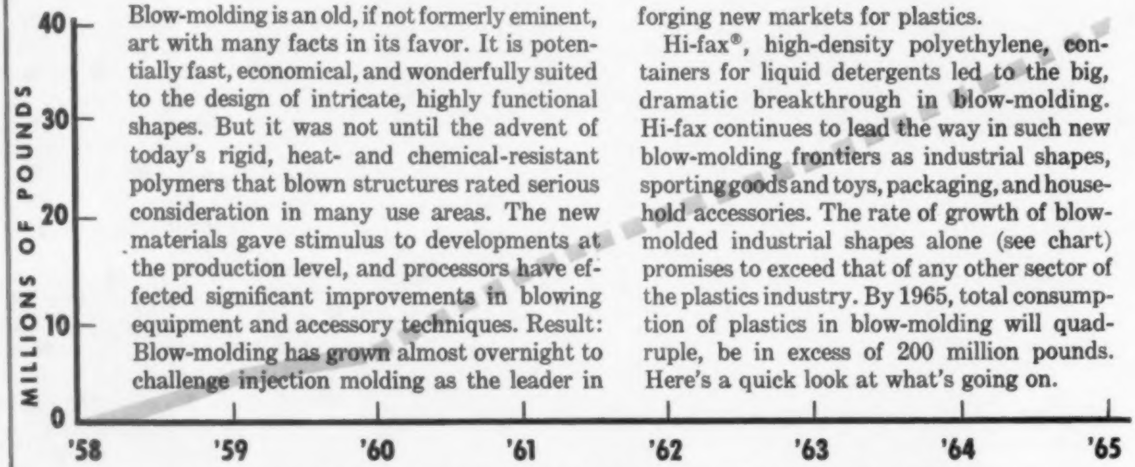
* Chief, Plastics Section, Materials Branch, USAERDL, Fort Belvoir, Va.
[1] Numbers in parentheses link to references at end of article, p. 148.
Adapted from USAERDL Report 1590-TR.

HERCULES **Plastics Hi-Lites**

Vol. II, No. 2

Blow-Molding challenges injection

As blown containers move full steam ahead, engineers see sizeable new markets for many types of blown structures.



Blow-molding is an old, if not formerly eminent, art with many facts in its favor. It is potentially fast, economical, and wonderfully suited to the design of intricate, highly functional shapes. But it was not until the advent of today's rigid, heat- and chemical-resistant polymers that blown structures rated serious consideration in many use areas. The new materials gave stimulus to developments at the production level, and processors have effected significant improvements in blowing equipment and accessory techniques. Result: Blow-molding has grown almost overnight to challenge injection molding as the leader in forging new markets for plastics.

Hi-fax®, high-density polyethylene, containers for liquid detergents led to the big, dramatic breakthrough in blow-molding. Hi-fax continues to lead the way in such new blow-molding frontiers as industrial shapes, sporting goods and toys, packaging, and household accessories. The rate of growth of blow-molded industrial shapes alone (see chart) promises to exceed that of any other sector of the plastics industry. By 1965, total consumption of plastics in blow-molding will quadruple, be in excess of 200 million pounds. Here's a quick look at what's going on.

PROJECTED GROWTH OF BLOW-MOLDED INDUSTRIAL SHAPES

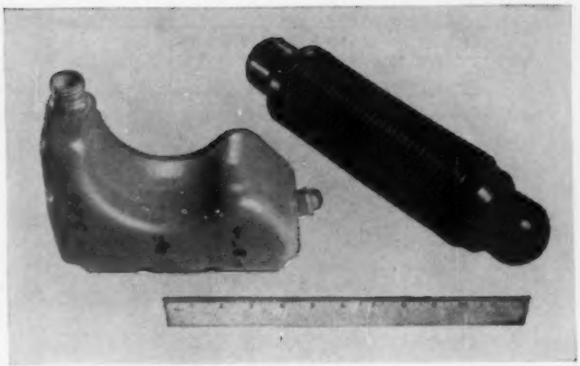
(1965 consumption of all forms of blow-molding will be in excess of 200 million pounds)

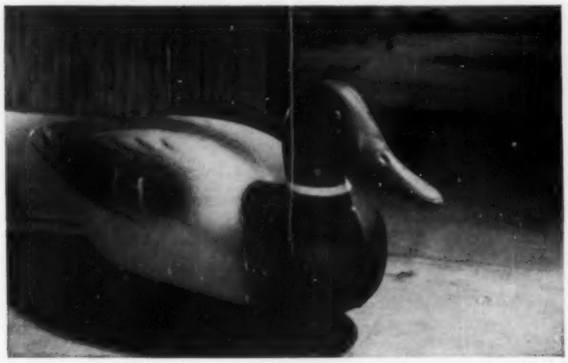
HOLD EVERYTHING?
WELL, NOT QUITE

The leading and pioneer material among the new polymers used in blow-molding is Hi-fax, high-density polyethylene. Hi-fax bottles are continually undergoing torture testing at the Hercules Plastics Applications Laboratory, where hundreds of candidates for plastics packaging have been checked out (see cut). Hi-fax won't package everything, and such testing has pointed up the few instances where the product was not compatible with plastic containers. No other high-density material has such an extensive exposure history either in the laboratory or in actual commercial use.

INDUSTRIAL SHAPES

Advanced automotive engineering concepts such as these point the way to tremendous growth in the use of Hi-fax for blown industrial shapes. The complex shape of windshield solution container (left) makes it possible to utilize former under-the-hood waste space in a compact car. Built-in bellows feature of high-density heater duct (right) provides a flexible, low-cost part adaptable to rapid, economical assembly. Both parts exemplify the fine combination of properties and processability offered by Hi-fax blown structures.





SPORTING GOODS AND TOYS

Blow-molded Hi-fax shapes offer the short, fast, low-cost route to the production of readily merchandised sporting goods and toys. Lifelike realism achieved in the duck decoy shown at left is typical of the effects possible with Hi-fax. Exciting new surface textures, excellent mold detail reproduction, and a broad color spectrum, combined with lightweight toughness, in a pleasant-to-handle, nontoxic material, make blown Hi-fax shapes a natural for these fast-moving, highly competitive markets.

DRUGS AND COSMETICS

Hi-fax has greatly broadened the horizons of designers of blown containers. Its combination of rigidity and chemical resistance now permits the use of plastic packages for a wide variety of drug and cosmetic products in exciting new shapes. Unique "Whitey the Whale" container in background holds bubble bath solution; later will serve as an appealing toy. Hi-fax blown shapes are ideal for secondary use and premium packages, at down-to-earth prices competitive with metal and glass.

HOME AND OFFICE

This handsome group of lampshades is a good example of the interesting and pleasing blown shapes which can be achieved in home and office accessories. Hardware, housewares, machine housings and decorative fittings are all fields where the esthetics and economy offered by Hi-fax blow-moldings must prompt their immediate consideration by all forward thinking producers.

Want more information about blow-molding? Look to the leader and pioneer in this field. Call or write:

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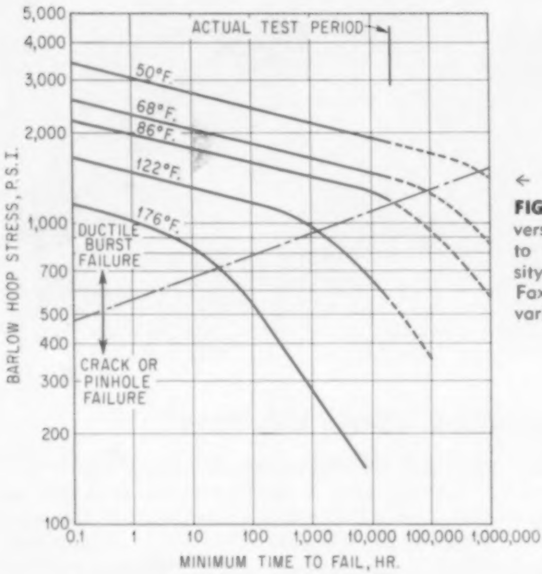


FIG. 1: Hoop stress versus minimum hours to fail for high-density polyethylene (Hi-Fax) pipe taken at various temperatures.

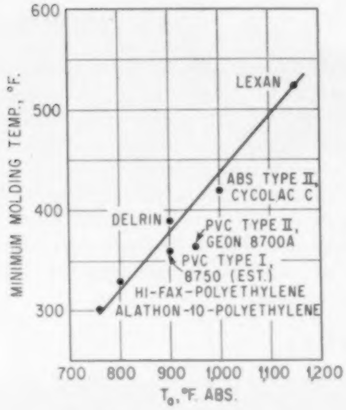
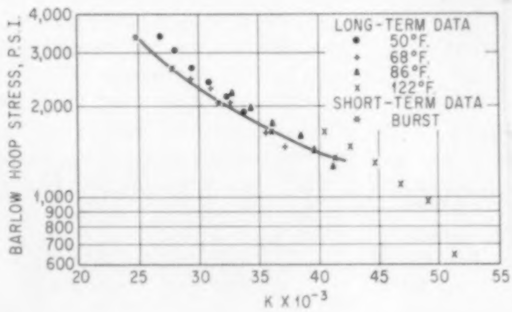


FIG. 2: Manufacturer's recommended minimum injection molding temperature compared with the best-fit zero strength temperature.

FIG. 3. Master rupture curve for high-density PE (Hi-Fax) pipe. T_0 = 800°F. absolute.



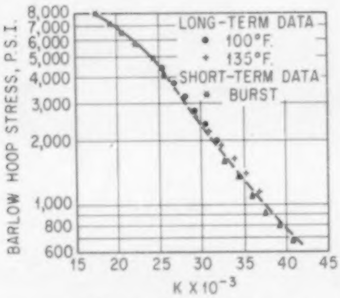


FIG. 4: Master rupture curve plotted for acrylonitrile-butadiene styrene (ABS Type II, Cycolac C) pipe. T_0 = 1000° F. absolute.

manner, in other words by applying a gradually increasing load until failure occurs, Eq. 1 should be applicable.

The zero strength temperatures (T_0) of the test materials have to be determined. The value of the SLTE should be the same (10^{-5} hr.) unless factors such as the cylindrical shape have some effect on the results.

Master rupture curves were drawn using long-term and short-term burst strength data (Tables II to V) presented by Sansone (1) for pipes made of the materials listed in Table I, p. 139. The results of long-term hydrostatic pressure tests on the high-density polyethylene were published originally by the Hercules Powder Co. and were based on original work performed in Germany by Richard on Ziegler polyethylene (Fig. 1, above). The hydrostatic data had been converted to rupture stresses by the use of Barlow's formula:

$$S = \frac{PD}{2t} \qquad \text{Eq. 2}$$

where S = hoop stress (p.s.i.), P = internal pressure (p.s.i.), D = outside diameter (in.), and t = minimum wall thickness (in.).

Trial and error and extrapolation of burst stress versus temperature curves were used to determine approximate values of T_0. Various values of the SLTE were also tried. Two criteria were used for acceptance of the parameter of the master rupture curve as correct: 1) degree of overlapping of long-term and temperature data over the useful stress range of the material; 2) degree of congruency between the master rupture curves for both short-term and long-term data. For acceptance, both criteria must be satisfactory. It was found that there is a relationship between T_0 and the minimum molding temperature (Fig. 2, above). The same value of SLTE, 10^{-5} hr., could be used for both static as well as burst strength tests.

Correlations between short-term and long-term strengths of high-density polyethylene are very good. Insufficient data are available to determine if the correlations are good for the other materials, but indications exist that they are.

High-density polyethylene

Although there was a large amount of data for this material compared to the others, the data were still relatively incomplete with regard to overlapping of short-term and long-term data. For example, while long-term data extended from almost 0 to 3400 p.s.i., burst strength data encompassed a stress range of only 1350 to 3375 p.s.i. As a result, all of the 176° F. data, as well as

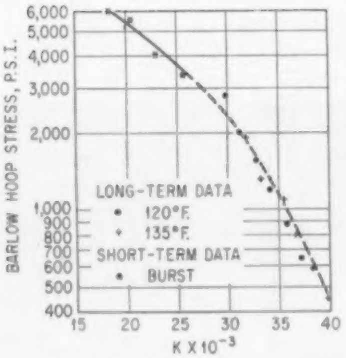


FIG. 5: Master rupture curve for PVC (high-impact, Type II, Geon 8700A) pipe. T_o = 950° F. absolute.

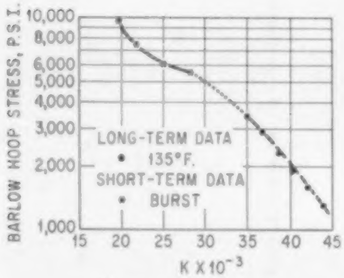


FIG. 6: Master rupture curve for PVC (normal impact, Type I, Geon 8750) pipe. T_o = 900° F. absolute.

data for 122° F. beyond 5 hr., could not be correlated.

Figure 3, p. 142, shows the master rupture curve when T_o was 800° F. absolute. Table VI, p. 148, shows good correlation between overlapping long-term data over the range covered by the curve based on burst strength data. The calculated stresses used for comparison with the observed stresses in Table VI were obtained by first calculating the K values using the time and temperature data and then taking the corresponding stress from the master burst curve in Fig. 3.

Richard (2,3) attempted to extrapolate his data to 100,000 hr. by drawing a line along the knees of the isothermal curves as shown in Fig. 1. Only the 176 and 122° F. curves have knees of any size. They are so broad, however, that lines could have been drawn with much smaller slopes with the result that the extrapolations of the 50, 68, and 86° F. lines would have been straight, if extended to 100,000 hr.; the 100,000-hr. data would then have been approximately as given in Table VII, p. 148. Therefore, Richard's 100,000-hr. data approach those that are predicted by the master rupture curve if the lines connecting the knees are drawn lower.

Acrylonitrile-butadiene-styrene (ABS) copolymer

There was a small amount of overlapping of the burst and long-term data at the beginning and end of both curves (Fig. 4, p. 142). It would appear, however, that a logical extrapolation of the burst curve would lead directly to the long-term data curve. A value of 1000° F. absolute for T_o was found to give best results.

Polyvinyl chloride (high impact, Type II)

In this case, there were no overlapping data for the burst and long-term strength (Fig. 5, left). There were barely enough data to determine the validity of the master rupture curve. There is a strong possibility that the burst curve would, if sufficient

Table II: Long-term and short-term strength data for high-density (0.945) polyethylene pipe.[a]

Temperature °F.	Temperature °F. abs.	Time (t) hr.	K[b]	Barlow hoop stress at failure p.s.i.
		Long-term strength data (2)		
50	510	0.1	26,700	3,400
		1	28,100	3,050
		10	29,500	2,700
		100	30,900	2,400
		1,000	32,300	2,150
		10,000	33,700	1,925
		100,000	35,100	1,700[c]
68	528	0.1	29,500	2,575
		1	31,000	2,300
		10	32,600	2,050
		100	34,100	1,835
		1,000	35,600	1,645
		10,000	37,200	1,460
		100,000	39,800	1,250[c]
86	546	0.1	32,700	2,200
		1	34,400	1,975
		10	36,100	1,750
		100	37,900	1,600
		1,000	39,600	1,430
		10,000	41,300	1,265
		100,000	43,000	950[c]
122	582	0.1	40,600	1,650
		1	42,700	1,475
		10	44,800	1,300
		100	47,000	1,160
		1,000	49,100	970
		10,000	51,200	660
		100,000	53,400	360[c]
		Short-term burst strength data (1)		
80	540	10^{-2}[d]	24,900	3,375
100	560	"	28,000	2,650
120	580	"	31,600	2,050
140	600	"	36,000	1,650
160	620	"	41,300	1,350

[a] Zero strength temperature (T_o) = 800° F. abs. [b] $K = \frac{T_o T}{T_o - T}(20 + \log t)$.
[c] Extrapolated beyond 22,000 hr. [d] Steady-load-time equivalent.

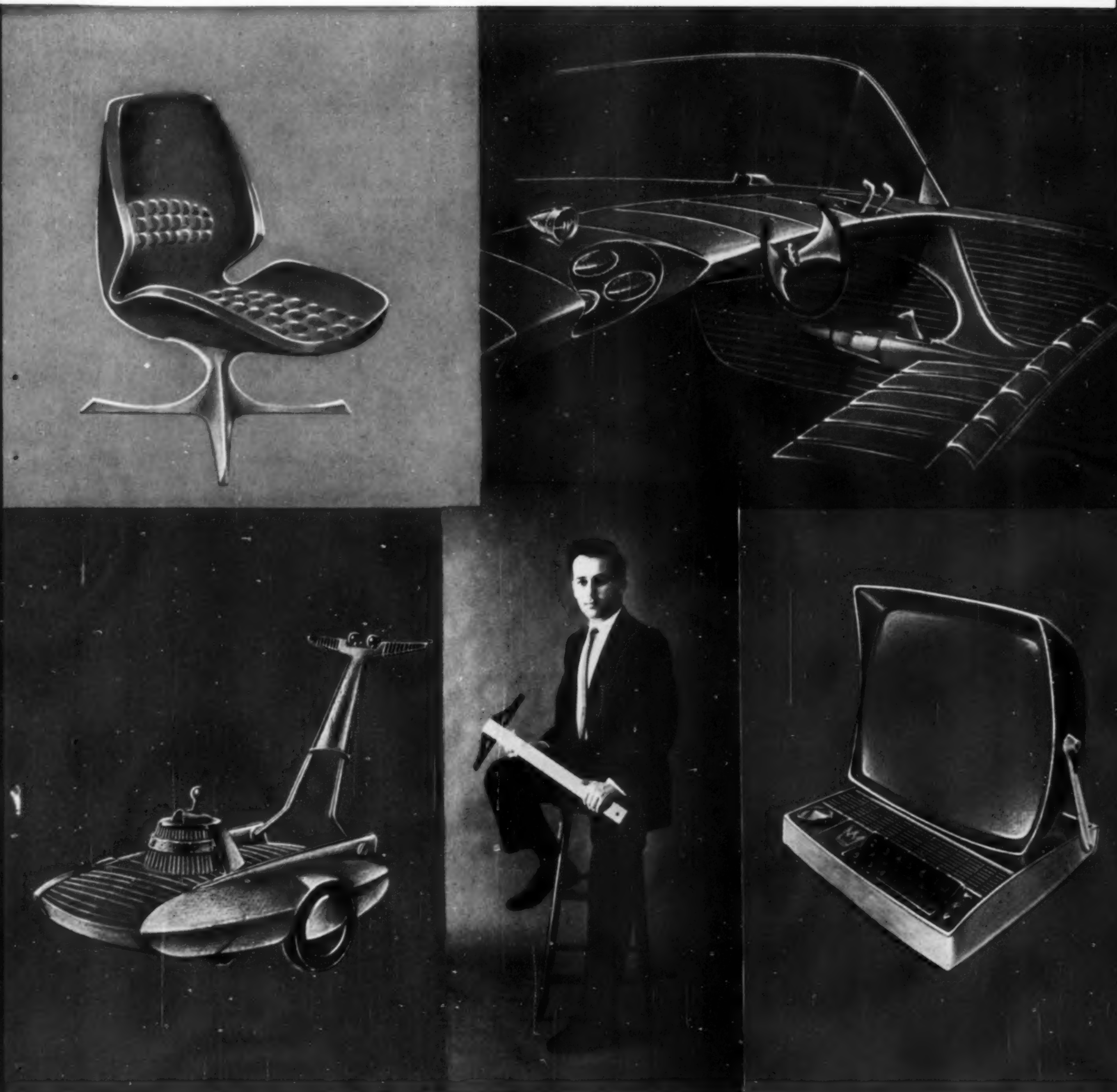


Table III: Long-term and short-term strength data for acrylonitrile-butadiene-styrene (ABS) Type II pipe[a] (1).

Temperature °F.	Temperature °F. abs.	Time (t) hr.	K[b]	Barlow hoop stress at failure p.s.i.
		Long-term strength data		
100	560	1	25,500	4,400
		10	26,800	3,750
		100	28,000	3,250
		1,000	29,300	2,750
		10,000	30,600	2,400[c]
		100,000	31,900	2,000[c]
135	595	1	29,400	2,600
		10	30,900	2,250
		100	32,300	1,900
		1,000	33,800	1,650
		10,000	35,300	1,420[c]
		100,000	36,800	1,150[c]
160	620	1	32,600	1,600
		10	34,200	1,350
		100	35,900	1,100
		1,000	37,500	925
		10,000	39,100	800[c]
		100,000	40,800	690[c]
		Short-term burst strength data		
80	540	10^{-5} [d]	17,600	8,000
100	560	"	19,100	7,250
120	580	"	20,700	6,550
140	600	"	22,500	5,900
160	620	"	24,500	5,000
170	630	"	25,600	4,100

[a] Zero strength temperature (T_o) = 1000° F. abs. [b] $K = \frac{T_o T}{T_o - T}(20 + \log t)$.
[c] Extrapolated beyond 2000 hr. [d] Steady-load-time equivalent.

Table IV: Long-term and short-term strength data for polyvinyl chloride (Type II, high impact) pipe[a] (1).

Temperature °F.	Temperature °F. abs.	Time (t) hr.	K[b]	Barlow hoop stress at failure p.s.i.
		Long-term strength data		
120	580	1	29,800	2,800
		10	31,200	2,000
		100	32,800	1,600
		1,000	34,200	1,200
		10,000	35,700	880[c]
		100,000	37,200	650[c]
135	595	1	31,800	1,900
		10	33,300	1,320
		100	35,000	1,100
		1,000	36,600	800
		10,000	38,200	590[c]
		100,000	39,800	450[c]
		Short-term burst strength data		
75	535	10^{-5} [d]	18,400	5,910
100	560	"	20,500	5,520
125	585	"	22,900	4,000
150	610	"	25,600	3,350

[a] Zero strength temperature (T_o) = 950° F. abs. [b] $K = \frac{T_o T}{T_o - T}(20 + \log t)$.
[c] Extrapolated beyond 5000 hr. [d] Steady-load-time equivalent.

data were available, continue and be congruent with the long-term strength curve as determined by the 120 and 135° F. data.

Polyvinyl choride (normal impact, Type I)

Very little data were available in the case of the Type I polyvinyl chloride. Only the burst data and the long-term data at 135° F. were presented. As a result, the master rupture curve could not be validated. At a value of 900° F. absolute for T_o, there was a possibility that the burst curve (Fig. 6, p. 144) would change its slope from concave upward to convex downward and so meet the 135° F. long-term data. That such an occurrence is not impossible may be seen from Fig. 3. The latter curve appears to change slope in the manner described here.

Zero strength temperature (T_o)

In order for use to be made of Eq. 1, the value of T_o must be calculable. One possible method is to plot a strength versus temperature curve and extrapolate it to about 1 p.s.i. In order to do this accurately, data at elevated temperatures and long strengths must be available. Strengths as low as 100 p.s.i. are required in order to determine the direction in which the curve is going. However, this type of data is not generally available, so that accurate results cannot be obtained.

Another possible method is to plot curves of the relationship between T_o and some easily determinable property. The heat distortion temperature is such a property, but rapid fall off in strengths at high stress levels could make the curve inaccurate.

A method that has given reasonably accurate results is the plot of the manufacturer's recommended minimum molding temperature versus T_o. This method has the virtue that such information is generally available. In addition, it is reasonable to expect such a plot to give good results since the materials would in all probability be in the same physical state, i.e., soft, plastic, and near the T_o. Figure 2 shows that the relationship is linear. Exact data for PVC Types I and II had

Table V: Long-term and short-term strength data for polyvinyl chloride (Type I, normal impact) pipe[a] (1)

Temperature °F.	Temperature °F. abs.	Time (t) hr.	K[b]	Barlow hoop stress p.s.i.
		Long-term strength data		
135	595	1	35,100	3,400
		10	36,900	2,900
		100	38,600	2,300
		1,000	40,400	1,900
		10,000	42,100	1,580[c]
		100,000	43,900	1,300[c]
		Short-term burst strength data		
75	535	10^{-5} [d]	19,800	9,670
100	560	"	22,200	7,440
125	585	"	25,100	6,160
150	610	"	28,400	5,530

[a] Zero strength temperature (T_0) = 900° F. abs. [b] $K = \frac{T_0 T}{T_0 - T}(20 + \log t)$.
[c] Extrapolated beyond 5000 hr. [d] Steady-load-time equivalent.

to be estimated. Allowable variation in T_0 was found to be approximately ±10 percent.

A study was made to determine the internal consistency of the data. It was found that the long-term data as shown in Fig. 1 were internally inconsistent with respect to at least one temperature. This is the case since the distances between the isothermal stress curves do not change in a regular manner. In all stable materials, the distances between isothermals either remain the same or gradually increase as the temperature rises. In Fig. 1, the distance between the 68 and 86° F. curves is less than the 50 and 68° F. curves. However, the temperature difference (18° F.) between both sets is the same. It is impossible to state which curve is correct.

In Fig. 3, the 176° F. data were far off the master rupture curve. The 122° F. data were also high. Thus, the validity of these data must be questioned. Richard (2) showed that there was wide scattering of the data obtained at 176° F. This may have contributed to the discrepancies noted.

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Table VII: Comparison of Richard extrapolated and master rupture curve stresses

Temp. °F.	Richard extrapolated stress p.s.i.	Richard stress if isothermals were straight to 100,000 hr. p.s.i.	Master rupture curve stress (Fig. 3) p.s.i.
50	1700	1700	1750
68	1250	1300	1410
86	950	1150	1300

Table VI: Correlation between short-term (burst) and long-term strength data for high-density polyethylene pipe

Observed Barlow hoop stress in long-term test (Fig. 1) p.s.i.	Time hr.	Temp. °F	K[a]	Stress from master rupture (burst) curve (Fig. 3) p.s.i.	Diff. between obs. and calc. stress[b] %
2500	0.2	68	30,000	2300	+ 8.0
2500	50	50	30,500	2240	+10.4
2000	0.7	86	34,100	1850	+ 7.5
2000	15	68	32,900	1950	+ 2.5
2000	4500	50	33,300	1910	+ 4.5
1500	300	86	38,700	1480	+ 1.3
1500	6000	68	36,900	1600	− 6.7
1850	22,000	50	34,200	1830	+ 1.1
1410	22,000	68	37,800	1550	− 9.9

[a] $K = \frac{T_0 T}{T_0 - T}(20 + \log t)$. [b] $\text{Difference} = \frac{\text{Observed stress (Fig. 1)} - \text{Calculated stress (Fig. 3)}}{\text{Observed stress}} \; 100$

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Izod Impact, Ft. Lbs./In. Notch	14.4	16.2	17.3	16.5
Tensile Strength, psi	20,300	21,300	20,100	19,300
% Elongation	1.89	1.92	1.94	1.87
Modulus of Elasticity in Tension, psi x 10^6	1.15	1.36	1.45	1.85
Flexural Strength, psi	33,150	33,600	37,800	37,000
Modulus of Elasticity in Flexure, psi x 10^6	1.08	1.18	1.44	1.20
Barcol Hardness (10 Sec. Reading) . .	55	57	62	66
Initial Viscosity of Mix	1,200	2,100	3,200	5,000
Glass Mat, % by Weight . . .	40	40	33.3	33.3

Diamond Chemicals

Spot tests for plastics

By Fritz Feigl* and Vinzenz Anger†

In a recent paper (1)[1] it was reported that certain types of synthetic fibers can be identified by detection of hydrolysis and adsorption effects by means of suitable tests. Pyrolysis reactions characteristic of certain organic compounds and the functional groups they contain may also be useful when testing synthetic resins and plastics. This paper deals with surprisingly simple solutions of several problems of this kind with the added assistance of spot test examination.

Plastics containing formaldehyde

Plastics or resins produced by condensing formaldehyde with urea, thiourea, melamine, or phenols release formaldehyde when heated with concentrated sulfuric acid. The aldehyde can be detected through the Eegriwe color test (2), which involves reaction with a mixture of chromotropic acid and concentrated sulfuric acid (3). The chromotropic acid may be replaced with advantage by veratrole (1,2-dimethoxybenzene) because a more stable reagent results (4).

Plastics containing phenol

The phenolic component of phenol-formaldehyde plastics can be detected through the fact that dry-heating of these materials yields phenol, which can then be identified in the gas phase by the Gibbs indophenol reaction. A blue color appears, due to the action of phenol with 2,6-dichloroquinone-4-chloroimine and ammonia (5,6). The fundamental reaction may be written as in Fig. 1, below.

Procedure: A granule of the sample is heated in a micro test tube over a bare flame. The mouth of the test tube is covered with a disk of filter paper that has been bathed in an ether solution of 2,6-dichloroquinone - 4 - chloroimine and then dried. After about 1 min. heating, the paper is exposed to ammonia vapor. A blue stain is seen if phenol is present.

Melamine resins

Acidic compounds of all kinds yield sulfur dioxide if heated to 140° C. with hydrated or anhydrous sodium thiosulfate. This product results from the liberation and decomposition of thiosulfuric acid. Ammonium chloride does not give sulfur dioxide under these circumstances, in contrast to chlorides of organic bases that are weaker than ammonium hydroxide, such as the weak base melamine (triaminotriazine). The chloride can be produced from melamine resins by fuming them with concentrated hydrochloric acid. Urea resins likewise are cleaved by hot concentrated hydrochloric acid, but the resulting urea undergoes rapid and complete hydrolysis:

$$CO\,(NH_2)_2 + 2\,HCl \rightarrow CO_2 + 2\,NH_4\,Cl$$

Since, as noted above, ammonium chloride does not react with sodium thiosulfate, fuming with concentrated hydrochloric acid and pyrolysis of the dry residue with sodium thiosulfate followed by detection of the sulfur dioxide in the gas phase can be combined into a specific test for melamine resins and also into a means of distinguishing them from urea resins. Sensitive tests for sulfur dioxide in spot test analysis are based on the change in color of appropriate reagent papers (7). The bluing of Congo paper, moistened with hydrogen peroxide, has proved excellent.

Procedure: A little of the sample is treated with one drop of concentrated hydrochloric acid in a micro test tube and the mixture is gradually heated to 190 to 200° C. in a glycerol bath until the vapors no longer turn Congo paper blue. Several cg. of sodium thiosulfate are added to the cold residue, and the mouth of the test tube is covered with a disk of Congo paper, moistened with 3% hydrogen peroxide. The contents of the test tube are then heated to 160° C. in the glycerol bath. If melamine resins are present, a blue stain appears on the paper.

Styrene resins

If aromatic compounds containing oxygen in the nucleus or in a side chain are dry heated, phenol results. The latter can be detected by the procedure described previously. When dealing with nitro compounds of this kind, it appears that a role is played in the splitting-off of phenol by the number of nitro groups per benzene ring. The authors have observed that aromatic nitro compounds with two or more nitro groups per benzene ring do not yield phenol when pyrolyzed. These findings can be utilized in working up a reliable test for styrene resins that are oxygen-free *per se*. The sample must be boiled down with fuming nitric acid (sp.gr. 1.5). Only *one* nitro group enters the benzene ring of the styrene, but there is also oxidation in the aliphatic chain. If **(To page 191)**

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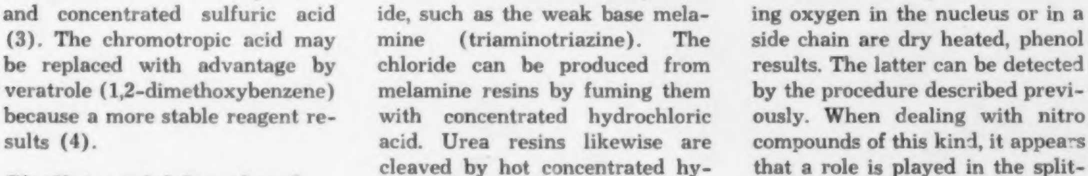
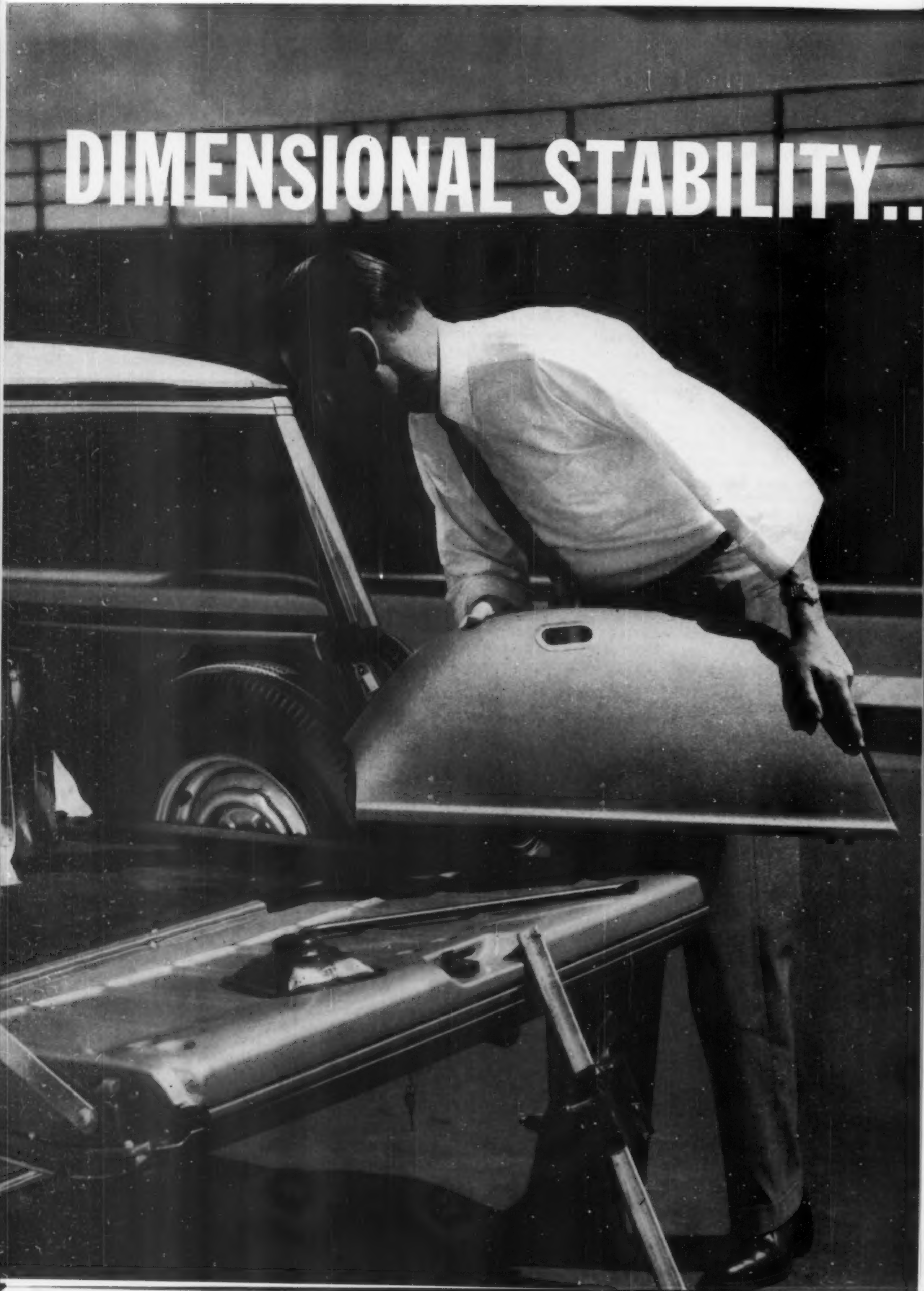
Translated by Ralph E. Oesper. University of Cincinnati, Cincinnati, Ohio.
[1]Numbers in parentheses link to references at end of article, p. 196.

FIG. 1: Identification test reaction for phenol.



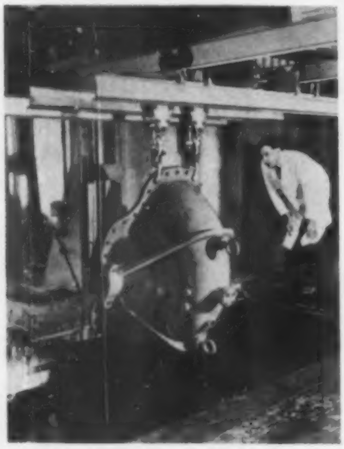

DIMENSIONAL STABILITY...

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Dip coating saves 50%

By switching from a spray-coated Neoprene to a dip-coated vinyl for a large oil refinery pump casing, a 50% cost saving was obtained.

The casing, consisting of two parts each, weighing 4½ tons, houses a



PUMP CASING about to be lowered into vinyl paste for anticorrosion coating.

22,000 gal./min. pump supplying the main salt water delivery for cooling at the Esso Refinery, Fawley, England. Each half was given an anticorrosive coating by dipping it in a trough of vinyl paste. Thickness of coating was 3/16 inch. Dipping was done by Durable Plastics Ltd., Surrey, using Breon PVC, supplied by British Geon Ltd.

RP store front

The store front of the KLM Royal Dutch Airlines ticket office, 62 E. Monroe St., Chicago, Ill., is fabricated of 12-gage folded plate or tubular sections of steel coated with polyester-fibrous glass.

The steel is sand blasted, undercoated, covered with 12 oz. fibrous glass fabric saturated with polyester resin in several applications, and built up to a thickness of approximately 1/16 inch. It is then sanded smooth preparatory to a sprayed on coat, which dries to a simulated orange-peel finish.

The final result yields an impervious colorfast protective sheath that is a logical substitute for aluminum. It is competitive in price, dentproof, and if damaged lends itself to easy repair by application of polyester. According to Harry Weese & Assocs., architects and engineers of Chicago, and designers of the new structure, the logical next step would be the fabrication of store front sections in pure reinforced plastics.

Keeps nylon parts in place

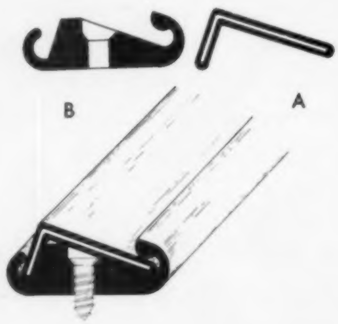
Small interlocking or interfitting parts of molded nylon, which are difficult to hold in place during assembly because of their inherent and desirable slipperiness, can be made to adhere to each other temporarily with a drop of fluoroalcohol, according to Du Pont. The fluoroalcohol acts as a very mild solvent to soften the adjoining surfaces of slippery parts and, in effect, "welds" them together. The temporarily joined parts can be physically separated again by the light mechanical stress encountered in normal operation of the assembled unit. Du Pont states that C3 Fluoroalcohol, one of five high fluorine content alcohols which became available commercially last year, was found to work effectively without damaging the plastic parts.

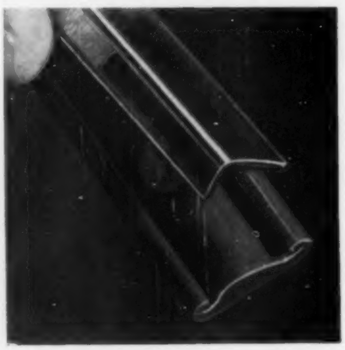
Molded acrylic thermostat molding

Dial and case in a new room thermostat by Detroit Controls Div. of American Standard Corp. are combined in a single molding of clear Plexiglas acrylic. The one-shot molding was designed by Lawrence H. Wilson Assocs., Detroit, Mich., industrial design consultants to Detroit Controls. Dial markings and emblem are hot stamped, and the case portion of the molding is second-surface painted in a gold satin finish. The emblem is shaped by a removable core in the mold, so that changes, if necessary, can be made without replacing the entire mold. Kent Plastics Co., Evansville, Ind., is the molder. The base and mounting plate of the thermostat are molded of clear Styron 683 styrene by C. F. Church Co., which is a division of American Standard Corp., Monson, Mass.

Double extrusions

Two-part trim molding design with a mechanical interlocking feature, developed by Anchor Plastics Co. Inc., Long Island City, N. Y., has opened new fields for extrusions. Up to now plastic trim moldings were usually applied with screws (undesirable because of visible fasteners), glued on (slow and costly), or press-fitted into slots (limited to wood). The new design combines the easy-to-install surface mounting feature with a most important one: concealed fasteners. The accompanying photograph and drawing show one design of a two-part trim molding. A Plasti-Brass (butyrate over metal) extrusion *A* is designed to snap into *B*, a solid plastic molding





also extruded of butyrate. *B* is first fastened to the appliance or cabinet with screws, rivets, or other mechanical means on the assembly line. *A* is snapped in later which assures that the decorative molding is not marred in any way during production. It also covers the fastening devices.

Plasti-Brass molding *A* can be hot stamped or otherwise decorated to serve as a name-plate or designation strip. The visible (To page 156)

(From page 154)

edge of molding *B* provides the two-tone effect and sets off the metal-like molding.

PVC tank lining

Polyvinyl chloride tank linings in the industrial vacuum cleaners marketed by Premier Co., St. Paul, Minn., cost one half as much and are more effective in resisting chemicals and abrasion than the previously-used stainless steel liners.

The vinyl plastisol coating is an optional feature on all five models in the line, the standard tank lining being baked enamel. Added costs for the PVC tanks range from $12.50 to $25 per tank on cleaners ranging in trade price from $136.50 to $321. If these units were offered with stainless steel tanks, additional costs would be double those of the PVC.

First step in the PVC application is to burn the inside of the already-formed tank to remove any grease or oil. A primer coat of plastisol is sprayed on this inner side and baked at 365° F. A second plastisol coat is sprayed over the primer to a thickness of 32 mils and is again baked at the same temperature. The baked enamel finish is then applied to the outside of the tank with no damage to the inner PVC lining.

All coating work is done by Jos. Wolkerstorfer Co., Minneapolis, Minn. The primer coat is C1314, and the outer coat S2008 plastisol, supplied by Michigan Chrome & Chemical Co., Detroit, Mich.

Double-duty epoxy

Epoxy resin served dual roles—as a laminating adhesive and as exterior finish—in the construction of a power boat (below) designed to test factors of speed, efficiency, and safety in military and pleasure craft.

The "skin" of the boat consists of pliable three-layer panels made by laminating fibrous glass cloth between two epoxy-coated mahogany veneers. The panels vary in thickness from $\frac{1}{20}$-in. for decking to $\frac{3}{4}$-in. for hull sides. Epoxy resin coated to the exterior of the hull forms a slick, moistureproof running surface.

The panels were laminated by Haskelite Mfg. Corp., Grand Rapids, Mich., and the boat constructed at Bay City, Mich. Epoxy resin, Bakelite ERL-2795, was supplied by Union Carbide Plastics Co.

Tester in PE

A high-density polyethylene housing for an electronic spark plug tester provides resistance to the rough wear, engine heat, and chemicals, grease and oil that are normally encountered in garages as well as service stations.

The spark plug tester, known as the Plug-Scope, was designed and

is manufactured by Heyer Industries Inc., Belleville, N. J., for Champion Spark Plug Co., Toledo, Ohio. The tester, a small oscilloscope, weighs slightly over 3 lb. and is equipped with a molded-in front grip for handling ease.

The piece that houses the viewing screen is injection molded by Wiggins Plastic Molding Co. Inc., Clifton, N. J. A two-cavity mold on a 6/8-oz. Reed-Prentice machine produces this part. The rest of the housing is molded by Fibro Corp., Clark, N. J., in a two-cavity mold on a 48-oz. H.P.M. machine (the large machine is used for greater uniformity of product). Grex high-density polyethylene is supplied by Polymer Chemicals, Division of W. R. Grace & Co.

Water shoes

Inexorably styrene foam marches on. Now Water Shoes Inc., Buffalo, N. Y., is offering a pair of such shoes at $44 retail through sporting

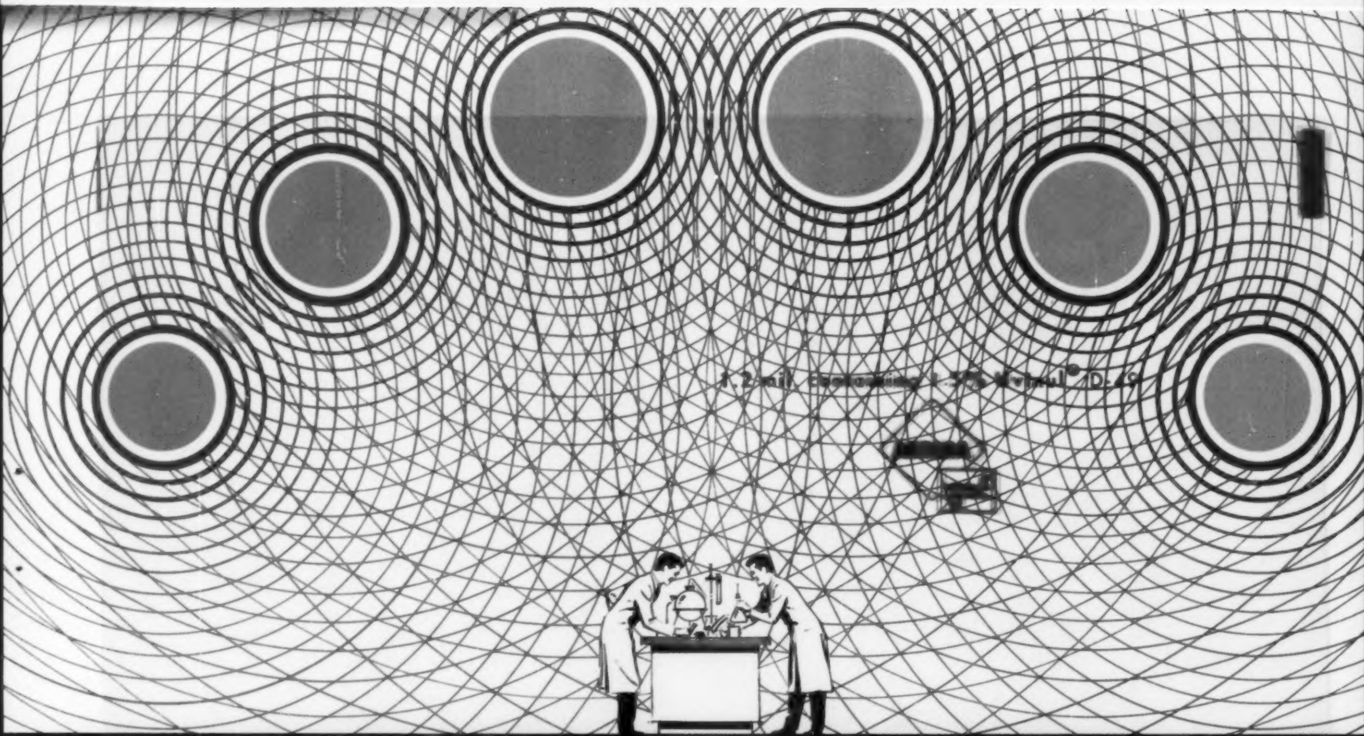
goods stores. The shoes are molded of Koppers' Dylite expandable polystyrene and can support up to 350 pounds. The nautical footware is effective in both shallow and deep water. Propulsion is provided by operating flexible flippers, which are set in at an angle on the undersides of the shoes.

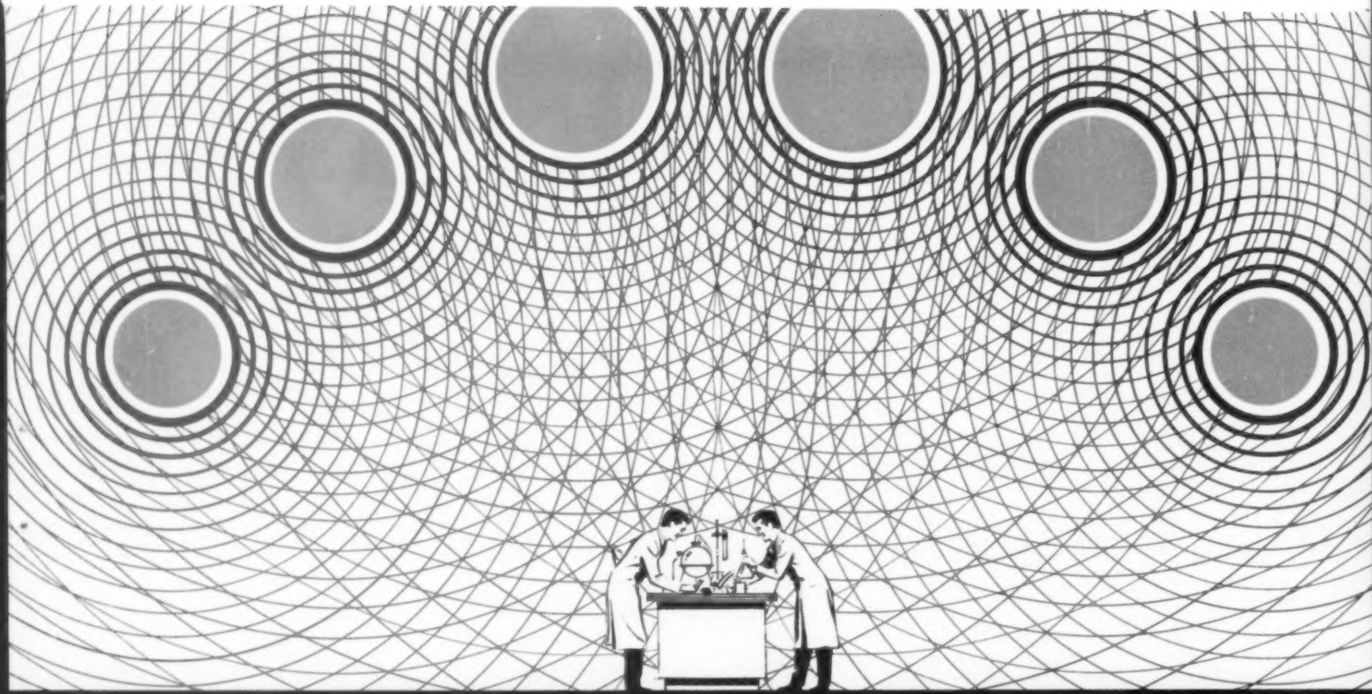
RP surfboard to rescue

The light weight, maneuverability, and buoyancy of a new all-plastics surfboard allows lifeguards to concentrate their attention on a rescue to a much greater extent than is possible when swimming or rowing a boat. Measuring 13 ft. long, 22 in. wide, and 4 in. thick, the board can be rapidly propelled by arm strokes from a prone position, and it provides room for lifeguard and the person rescued.

Manufactured by Hains-Russell Co., Hicksville, N. Y., these surfboards have a rigid polyether urethane foam core with a density of 2.8 lb./cu. ft., which is handshaped from slab stock, and fibrous glass reinforced epoxy skins. The epoxy resin is Bakelite ERL-2795, produced by Union Carbide Plastics Co. The skins protect the board from attack by sun and salt water, and keep the foam interior dry and buoyant. The board weighs about 40 pounds.

More New Developments on p. 160





Covers Details of

New designs bring beauty to waste containers

New designs bring beauty to waste containers

Those who have wondered why the inherent decorative potential of plastics has never been fully realized in wastebaskets and trash cans need wonder no more. The line of polyethylene containers introduced by Loma Industries, Ft. Worth, Texas, at the recent housewares show has added the touch of glamour to a traditionally plain looking product and has made it attractive enough to be proudly shown. The designs were developed by Alan Berni, noted American stylist.

The new line is shown in the photographs below, together with dimensions and suggested retail prices. A look at the latter shows clearly that the economic position of polyethylene containers has remained unimpaired—despite the additional design factors.

The trash can, which has a capacity of 32 gal., and is claimed to be the largest such polyethylene trash can offered so far, has molded-in intaglio decorations which, according to Loma, make it attractive enough to keep in front of the house. It is produced of a blend of polyethylene and copolymers to make it stress crack resistant. Molding is done by Loma on a 300-oz. Watson-Stillman injection molding machine. The lid is molded separately of Grex high-density material supplied by W. R. Grace & Co. The wastebaskets are produced in single cavities on 80-oz. machines, using medium-density resins from several suppliers.

The two-tone wastebasket is fabricated from two separate moldings that are slip-fit together and held in place by brass rivets. The sunburst decoration on the basket in the center of the bottom row of the photographs is produced by hot stamping with gold leaf after the basket has been flame treated. The pierced flare top of the basket in the lower right-hand corner is achieved as part of the molding operation. The trash can shown is only one of several models. Three others of the same basic design but with smaller capacities are also offered, as follows: 12-gal.-$6.95; 20-gal.-$9.95; 26-gal.-$11.95.

According to Loma, initial trade reactions have been enthusiastic and are expected to lead to further penetration of polyethylene into the housewares field.

(More New Developments on p. 164)

WASTE CONTAINERS, shown left to right top, are: Flaretop #304, 12 in. tall, 11½ in. diam. at top, $1.98; Star Design #303, 16 in. tall, 10½ in. sq. at top, $3.98; 32-gal. trash can, $14.95. Bottom (l. to r.): Two-tone #300, 14 in. tall, 12 in. diam. at top, $2.98; Rectangular #309, 13 in. tall, 11½ by 9 in. at top, $2.98; and Pierced #308, 11 in. tall, $1.09.






Vinyl dog collar adjusts

The Regal Co. Inc., Woodstock, Va., is prepared to service America's dog population (26 million and growing) with a single model vinyl collar which can be adjusted to fit any canine neck from 11 to 23 in. in circumference. Retail price is \$2.00.

The tough, lightweight collar is produced at Regal by extruding a modification of Firestone's Exon 500 PVC about a seven-strand tinned twisted copper cable. The straight extruded piece is then assembled into the collar shown in the photo below using three black fittings injection molded of Du Pont Zytel 101 nylon. The two side fittings are fastened to the vinyl piece with self-tapping screws and slide back and forth as the collar is adjusted. The bottom fitting has a locking screw which holds the adjusted circle in place; there is a ¼ in. hole in the thumbhead for a leash snap.

Epoxy saves \$2000

An epoxy resin coating troweled onto the acid fume exhaust stack (steel) of a pickling plant cost only \$1800, which was over \$2000 less than the cost of a comparable rubber lining system. The entire operation took 14 hr., compared to the four- to six-week period required for rubber lining. The chemically-resistant epoxy coating, expected to last at least five years, is based on Shell Chemical's Epon 820 resin and formulated by Fibre Glass-Evercoat Co. Inc., Cincinnati, Ohio.

New face for walls

Walls, traditionally flat surfaces, have been given a new aspect with the introduction of Formica Corp.'s "snap-on" paneling treatment. Very

thin strips of the laminate on ¼-in. corestock are secured floor to ceiling on 14-in. centers. The wall is then simply completed by buckling 17-in. wide sheets of unsupported decorative laminate into the spaces between the anchoring strips. Savings in labor and material are achieved through the elimination of subwall construction and a full veneering operation.

According to Formica, impact resistance of the snapped-on panels is high, considering the absence of full support of rigid core material. The company states that the panels' curvature causes all but very severe

direct blows to glance off. In cases where damage does result, panels are easily replaced.

. . . And in brief

• Service tables made by Arvey Corp., Chicago, Ill., now have tops surfaced with Mylar polyester film. This is among the first furniture applications for this polyester film.

• Unpainted mask plaques molded of Koppers' Dylite expandable polystyrene are offered in a paint-it-yourself kit (together with brushes and paint) at $1.98. Manufacturer is Dixon Mfg. Co., S. El Monte, Calif.

• Expanded aluminum foil, produced by Research Products Corp., Madison, Wis., can be fabricated into novel decorative plastic sheeting.

• Gears cast from Rexolite 1422 and custom-machined to tolerances as close as 0.0005 in. are offered by The Rex Corp., West Acton, Mass. They are said not to cold flow and to have high tensile strength. Prototype gears have been used successfully in airborne instrumentation, and have been suggested as components in microwave metering devices, the company states.

Rexolite 1422 is one of a family of microwave dielectric materials finding increasing use because of their dimensional stability, radiation resistance, lightness in weight, and modifiability of their physical, chemical and electrical properties.

• Ties made of vinyl with a wire core for closing polyethylene bags, tying labels to packages and holding items to cardboard backing, are currently being made by Plas-Ties Co., Santa Ana, Calif.

• Home owners and builders can add interest to garage doors with a new series of decorative scrolls and windows vacuum formed from butyrate sheet by Taylor Garage Doors Inc., Detroit, Mich. Sheet used is extruded by Cadillac Plastic & Chemical Co., Detroit, and Campco Div., Chicago Molded Products Corp., Chicago, Ill.

• Handsome 125-ft. fence of translucent fibrous-glass-reinforced plastic panels intended to attract motorists to the Turf Motel, Cicero, Ill., proved so effective that it became necessary to finally dismantle it to make room for new dwelling units. A new fence will be erected. The panels were produced by Filon Plastics Corp., Hawthorne, Calif.—**End**

LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Acrylic Resins" *by Milton B. Horn.*

Published in 1960 by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 184 pages. Price: $4.50.

This fourteenth volume in the Reinhold Plastic Application Series covers casting and molding resins, and resin suspensions and emulsions. Semi-technical in nature, the book begins with a brief review of the chemistry of acrylic monomers and polymers. Chapters 3, 4, and 5 discuss the manufacture, application and fabrication of cast and molding materials. The next four chapters are devoted to the preparation and use of acrylics in emulsion, suspension, and monomer form. The last chapter covers trends in the industry. A good primer for the readers seeking a background in methacrylate materials.—*G.R.S.*

"Plastics Engineering Handbook" of the Society of the Plastics Industry Inc., 3rd Edition.

Published in 1960 by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 565 pages. Price: $15.00.

Familiar to most people in the plastics industry, this clearly written reference on plastics materials, methods, and fabrication has been revised, expanded, and brought completely up-to-date. Among the new material is information on nomenclature, cellular plastics (foam), decorating, welding, and plastics as adhesives. Included in the articles is the experience of over 200 technicians and authorities. One of the best books for the reference shelf in plastic laboratories, schools, and production plants.

"Plastics Technical Dictionary," Volume II, German-English *by Annemarie Wittfoht.*

Published in 1959 by Carl Hanser Verlag, Munich, Germany. 572 pages, numerous illustrations. Price: DM 58.00 (About $14.50).

This second volume maintains, and perhaps even surpasses, the high standard set by Volume I (English-German), which appeared in 1956. "Dictionary" is far too modest a description of this book, which is really a plastics encyclopedia in two languages, in alphabetical order. Numerous flow charts and tables accompany the dictionary section and explain the processes and machinery involved. References to ASTM, British, NEMA, ISO, and DIN test methods and standards are quoted wherever applicable. Processing methods and plastics machinery are clearly explained and illustrated. Conversion tables are also included. The dictionary differentiates between American and British usage and nomenclature.—*G.B.*

Polypropylene. Properties, applications, etc., for general-purpose, heat-resistant, and food-grade polypropylene. 4 pages. *Catalin Corp. of America, 1 Park Ave., New York 16, N. Y.*

Polystyrene foam board. Physical properties, uses, etc., for Genafoam, an expanded polystyrene foam board for insulation, sandwich construction, plaster base, etc. 12 pages. *General Foam Plastics Corp., 801 Mount Vernon Ave., Portsmouth, Va.*

Dryers and ovens. Specifications, uses, etc., for a line of industrial dryers and ovens used in plastics and a number of other industries. Bulletin ID-300. 4 pages. *J. O. Ross Engineering, 730 Third Ave., New York 17, N. Y.*

Thermocouple adapter. Specifications for a new spring-loaded thermocouple adapter which converts ⅛ or 1/16-in. diameter metal-sheathed thermocouple to a spring-loaded, bayonet-lock type with adjustable immersion length. Bulletin 2-A. 2 pages. *Thermo Electric Co. Inc., Saddle Brook, N. J.*

Filling equipment. Sizes, uses, etc., for a line of filling equipment—automatic plastic tube fillers, closers, and crimpers for pastes, creams, and liquids; single, twin, and multiple liquid fillers; single-operation fillers, closers, and crimpers—for the plastics, chemical, paint, food, and other industries. Catalog AC-60. 8 pages. *Arthur Colton Co., 3400 E. Lafayette Ave., Detroit 7, Mich.*

Plastisol molding. "The Rotational Molding of Plastisol Items," 5 pages; "Plastisol Viscosity — Temperature Characteristics," 13 pages; "Rotational Molding of Hollow Goods," 4 pages; "Rotational Molding of Plastisols," 7 pages; and "More Bounce in Vinyl Balls," 5 pages; are the titles of five complimentary reprints available from *The Akron Presform Mold Co., Cuyahoga Falls, Ohio.*

Electrical papers. Product information, production and electrical testing facilities, and other data relating to a line of electrical papers, which are used, among other things, as a laminating base. 4 pages. *Riegel Paper Corp., 260 Madison Ave., New York 16, N. Y.*

Nylon brushes. Names and addresses of manufacturers who produce 121 different types of nylon brushes. Introduction includes data on how to determine the quality of a brush. 30 pages. *E. I. du Pont de Nemours & Co., Wilmington 98, Del.*

Hydraulic cylinders. Advantages of using straight thread ports in hydraulic cylinders. Brochure contains table for determining proper straight thread port sizes from 1½ through 8-in. bore cylinders. Bulletin S-113-1A. 2 pages. *Hannifin Co., Des Plaines, Ill.*

Epoxy resins. Typical formulations, properties of castings, chemical resistance, high-temperature characteristics, uses, and other technical data for Oxiron epoxy resins—2000, 2001, and 2002. 24 pages. *Food Machinery & Chemical Corp., 161 E. 42nd St., New York 17, N. Y.*

Electric heaters. Specifications, features, etc., for a line of electric heaters for controlled temperatures of extruders, calender rolls, presses, kettles, platens, dies, and similar machinery and equipment. Bulletin 108. 4 pages. *Gerin Mfg. Co. Inc., 683 N. 5th St., Newark 7, N. J.*

Current Uses for Electroforming. Sections of this booklet include: "When to Use Electroforming," "The Electroforming Process," "Good Electroforming Practices," "Test Results and Charts," "Normal Electroform Distribution," and others. 34 pages. *Allied Research & Engineering, Div. of Allied Record Mfg. Co., 6916 Santa Monica Blvd., Los Angeles 38, Calif.*

Rivets. Features, sizes, uses, and other data for a line of rivets used in fastening plastics to plastics, metal to plastics, **(To page 169)**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metal to rubber, etc. 8 pages. *Pop Rivet Div., United Shoe Machinery Corp., Shelton, Conn.*

Polypropylene. Physical characteristics, injection molding and extrusion data, fabricating techniques, types available, packaging and shipping, applications, etc., for Pro-fax polypropylene. 22 pages. *Hercules Powder Co., Wilmington 99, Del.*

Directory of Plastic Packaging Suppliers. Alphabetical listing of custom and proprietary plastics packaging molders and extruders in the United States. Directory C-10-211. 36 pages. *Plastics Div., Koppers Co. Inc., 801 Koppers Bldg., Pittsburgh 19, Pa.*

Blow molded products. Describes a line of blow molded products—cookie jars; condiment dispensers; salt and pepper shakers; decanters; and sprinkling bottle. 4 pages. *Star Plastic Specialties Inc., 215 A St., Boston 10, Mass.*

Plastic molding machinery. Specifications, features, uses, etc., for a line of plastics molding machines—injection, compression, transfer, RP, and others. Bulletin 6030-B. 6 pages. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Plastic molded drawers. "Top Drawer Secret for Selling Homes" gives the advantages of using plastics drawers, and shows how builders have reportedly cut labor costs by up to 50 percent. 10 pages. *Plastics Div., Monsanto Chemical Co., Springfield 2, Mass.*

Polyvinyl chloride. Mechanical, thermal, and physical properties; chemical and solvent resistance; physiological behavior; processing; applications; etc., for Hoechst's Hostalitz Z, impact-resistance polyvinyl chloride. 18 pages. *United States Representative: Westco Chemicals Inc., 6850 Tujunga Ave., North Hollywood, Calif.*

Phenolic laminates. Properties, sheet sizes, and other data for Grade ARF-HT high-temperature, asbestos mat-phenolic resin. 1 page. Similar data for Grade G3-HT high-temperature, glass fabric-phenolic resin. 1 page. *Synthane Corp., Oaks, Pa.*

RP tanks. Case history showing the advantages of using reinforced plastics tanks for gases, chemicals, and liquids. 1 page. *Structural Fibers Inc., 5th Ave., Chardon, Ohio.*

Fasteners. Sizes, uses, features, etc., for a line of tapped hole, knurled, and finned inserts for plastics and other castings, which are said to be engineered to tolerances of ±0.002 inch. 8 pages. *Boots Corp., Newtown Turnpike, Norwalk, Conn.*

Thermoforming machine. Performance data, operating techniques, and specifications for the Hydro-Chemie Formpack R-4 thermoforming machine for producing thin-walled packages, cups, and similar items. 2 pages. *Conapac Corp., 120 E. 13th St., New York 3, N. Y.*

Industrial scales. Features, uses, etc., for a line of industrial weighing equipment — portable, bench, floor, built-in, motor truck, counting, net weight packing, and mail. 7 pages. *Toledo Scale, Div. of Toledo Scale Corp., Toledo, Ohio.*

Portable inking machine. Features, uses, etc., for a portable inking machine that is used for coloring raised surfaces in instances where masking for spray painting or hot stamping is not suitable. 1 page. *Conforming Matrix Corp., Toledo Factories Bldg., Toledo 2, Ohio.*

Anti-statics. Prices, uses, etc., for a line of compounds which destaticize and prevent static-caused dirt and dust attraction on plastics; remove electro-static charges; etc. Bulletin 5. 4 pages. *Merix Chemical Co., 2234 E. 75th St., Chicago 49, Ill.*

Taps. Sizes, prices, uses, etc., for a line of taps, which are used for tapping plastics and other materials. Similar data for gages, thread comparators, thread milling cutters, and fine pitch gear hobs. 26 pages. *The Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 2, Conn.*

Defense Directory of Missile Ground Support Equipment Agencies. Lists military agencies responsible for development of missile ground support equipment. Includes various components that can be fabricated from plastics materials. PB 161103. 20 pages. Price: 50 cents. *OTS, U. S. Department of Commerce, Washington 25, D. C.*

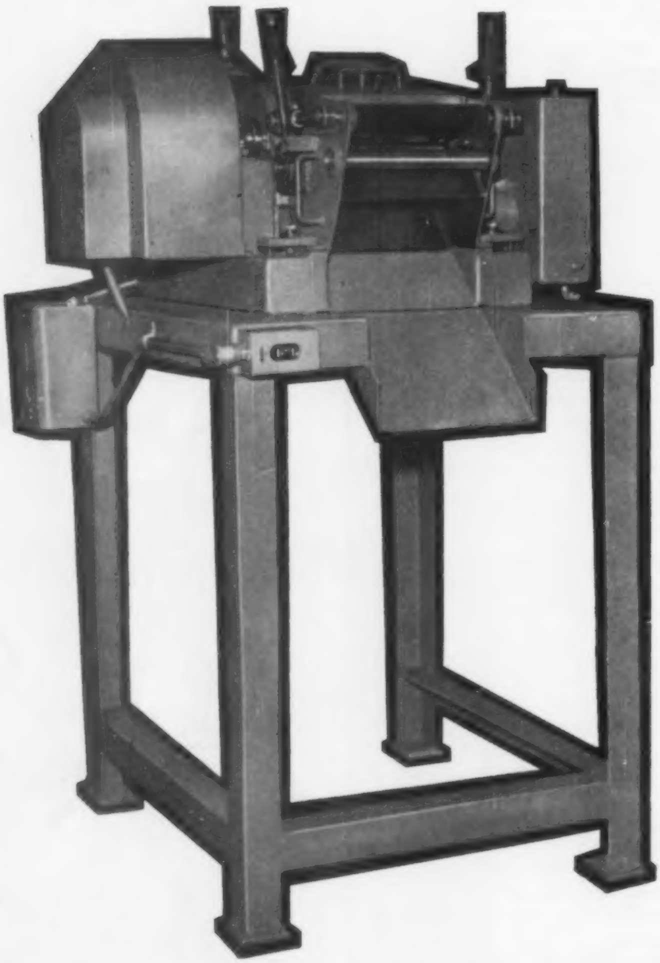
RP pipe. Features, sizes, temperature and pressure comparison graph, etc., for a line of fibrous glass reinforced epoxy pipe and fittings. 2 pages. *Ed Conley Plastic Corp., 91st and Delaware, Tulsa, Okla.*

Ketones. Applications, coatings, formulations, physical properties, shipping and storage, specification limits, test methods, and other technical data (To page 172)

8 REASONS WHY PLASTICS MEN NOW REGARD

ALSTEELE PELLETIZERS

AS THE NEW STANDARD OF THE INDUSTRY



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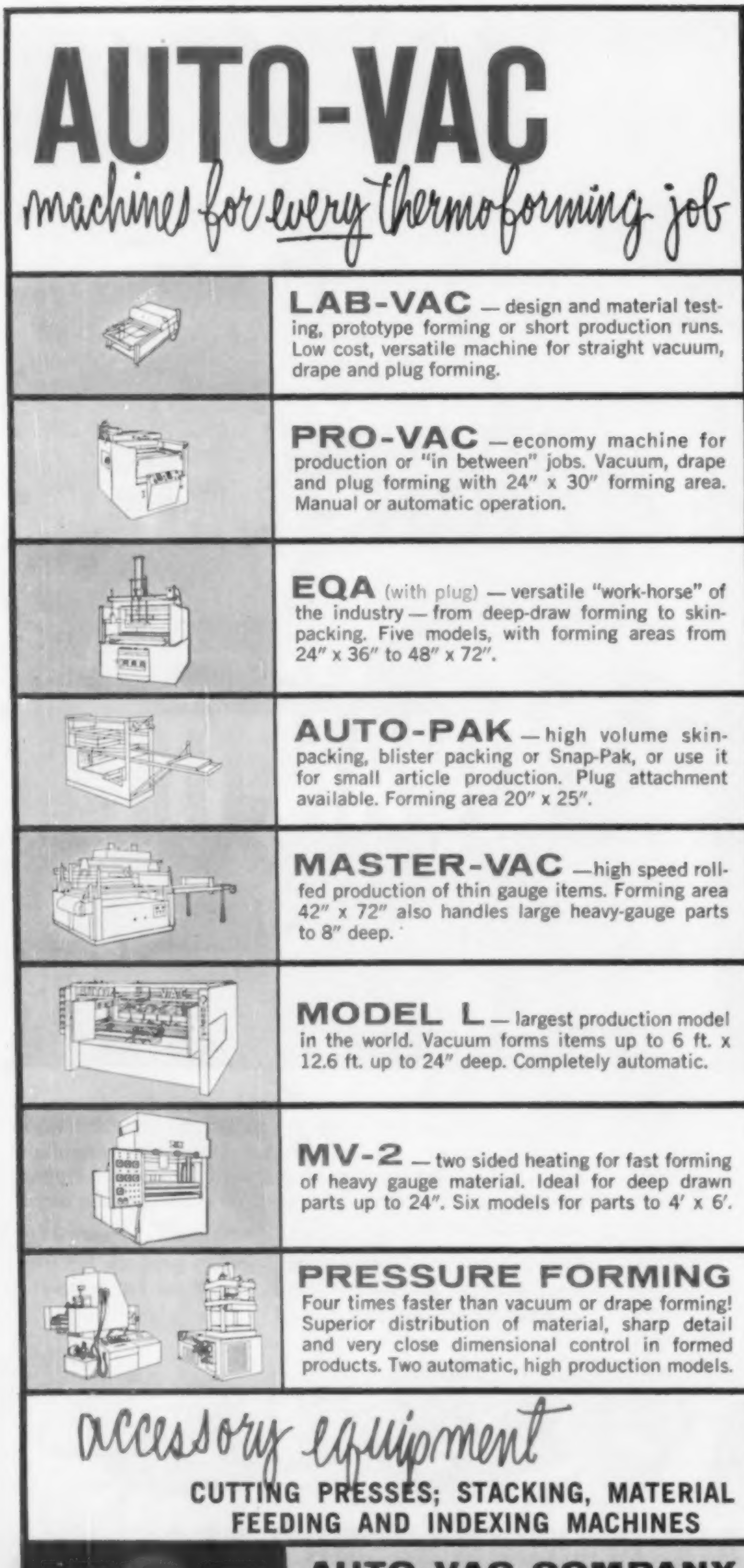

for 15 ketones and diketones, which are solvents and chemical intermediates for nitrocellulose, and other cellulose esters, vinyl chloride-acetate, etc. 48 pages. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Air cylinders, accumulators. Features, specifications, uses, etc., for a line of air and hydraulic cylinders, accumulators, hydraulically controlled air power units, and boosters for the plastics and other industries. Bulletin P2546P. 24 pages. *Flick-Reedy Corp., Bensenville, Ill.*

Ultrasonic thickness testers. Data on two portable testers—Models 5 and 6—used for measuring the thickness of rigid plastics, metals, glass, etc. Includes specifications and working data for accessory transducers. Bulletin A-200. 8 pages. *Branson Instruments Inc., 40 Brown House Rd., Stamford, Conn.*

Power tools. Specifications, uses, etc., for a line of power tools—saws, cutters, drill presses, grinders, jig saws, lathes, planers, sanders, shapers, etc.—for cutting, drilling, and finishing plastics, metal, and wood. Catalog 60. 44 pages. *Boice-Crane Co., 972 W. Central Ave., Toledo 6, Ohio.*

Take-off machine. Specifications, take-off speed ranges, dimensional capacity, drive details, uses, and case histories for the Universal take-off machine that reportedly can be used with any extruder. Catalog FM-110. 12 pages. *Farris Universal Machine Corp., Palisades Park, N. J.*

Coatings for Vacuum Metallizing. Booklet describes in detail the application and use of vacuum metallizing coatings, which may be applied by spraying, dipping, and flow coating to thermoplastics, thermosetting plastics, metals, and glass. Also discussed are base coats for use before metallizing and top coats and back-up coats for use after metallizing. 45 pages. *Bee Chemical Co., Logo Div., 12933 S. Stony Island Ave., Chicago 33, Ill.*

Infra-red. Principles, advantages, applications, and typical standard systems concerning infra-red for baking, drying, dehydrating, preheating, and degreasing. 20 pages. *Fostoria Corp., Infra-red Div., Fostoria, Ohio.*

Vinyl copolymer. General, mechanical, and thermal properties for Vipla-TNT/A, an internally plasticized vinyl copolymer developed by Montecatini Soc. Gen., Milan, Italy,

for sheetings, tubings, etc. 2 pages. *Chemore Corp., 2 Broadway, New York 4, N. Y.*

Urethane elastomer. General properties, comparison of elastomer properties, applications, advantages, etc., for Daycollan, a new urethane elastomer. 4 pages. *The Dayton Rubber Co., Dayton 1, Ohio.*

Vulcanized fibre. *Clues* is the name of a bulletin to be issued periodically dealing with vulcanized fibre and laminated plastics. Vol. 1, No. 1 discusses applications, properties, etc., for vulcanized fibre. 4 pages. *Taylor Fibre Co., Norristown, Pa.*

Vibratory feeders. Features, specifications, dimensions, applications, etc., for a line of vibratory feeders; spreader feeders; heat-resistant furnace feeders; drying, preheating, and cooling feeders; picking tables; conveyors; and elevator feeders. 32 pages. *Syntron Co., 390 Lexington Ave., Homer City, Pa.*

Fibrous glass pipe-fitting insulation. Design advantages, thicknesses available, uses, etc., for FIT*rite molded fibrous glass pipe-fitting insulation. Bulletin TD-105-1A. 4 pages. *Fibrous Glass Products Inc., Alpa Plaza, Hicksville, N. Y.*

Structural adhesives. Properties, advantages, design concepts, uses, case histories, and other data on Scotch-Weld structural adhesives, joint designs, and bonding methods, etc. 16 pages. *Minnesota Mining & Mfg. Co., Adhesives, Coatings, and Sealers Div., St. Paul 6, Minn.*

Tributyl aconitate. Properties, uses, toxicity, packaging, etc., for tributyl aconitate, which is a plasticizer-stabilizer for vinylidene chloride polymers and copolymers. Data Sheet 552. 3 pages. *Chas. Pfizer & Co. Inc., 630 Flushing Ave., Brooklyn 6, N. Y.*

Polyethylene. "Printing of Polyethylene" discusses methods of treating PE film for printability; methods of printing PE; printing inks; field test methods; and includes glossary. 16 pages. "Petrothene Resinas de Polietileno" is a Spanish edition of a brochure listing specifications and processing information on Petrothene PE resins. 14 pages. *U. S. Industrial Chemicals Co., 99 Park Ave., New York 16, N. Y.*

Plastic printing paper. Characteristics, grade information, uses, etc., for Texoprint, a paper material impregnated and coated (To page 175)

with plastic, which is used for wall charts, maps, etc. 2 pages. *Kimberly Clark Corp., Neenah, Wis.*

Thermoplastic resins. "Plastics for Product Designers" gives properties, chemical resistance, formulations, advantages, applications, etc., for a line of nylon, polypropylene, and polyethylene. 8 pages. *Spencer Chemical Co., Kansas City, Mo.*

Plastic shoe heels. "Cycolac GS—the First Plastic To Be Designed Specifically for Shoe Heels" gives strain records for normal and brisk walking; typical properties of shoe heel plastics; comparative molding conditions; and other technical data. Industrial Bulletin 1. 12 pages. *Marbon Chemical, Div. of Borg-Warner, Washington, W. Va.*

Epoxy floors. Reports on properties of industrial flooring, 4 pages. *Kalman Floor Co. Inc., 110 E. 42nd St., New York 17, N. Y.*

Tool and die directory. The 1960-61 Directory of the TDI lists the specialized tooling facilities of over 500 regular and associate members in the Chicago area, including those facilities geared to plastics. 126 pages. *Tool & Die Institute, 2435 N. Laramie Ave., Chicago 39, Ill.*

PE film standard. Printed edition of Commercial Standard CS227-59, Polyethylene Film, is available from OTS. Standard covers dimensional tolerances, types, grades, classes, and kinds of PE film; intrinsic quality requirements; and test methods. Price: 15 cents. *Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.*

Structural adhesives. Describes complete line of structural adhesives, laminating materials, putties, and sandwich core. Bulletin includes temperature chart that indicates the upper and lower service limits for each Narmco adhesive and laminating material. 6 pages. *Narmco Resins & Coatings Co., 600 Victoria St., Costa Mesa, Calif.*

Isophthalic. "Oronite Isophthalic . . . Its Use and Performance in Plastics Materials" covers uses and performance data for isophthalic in reinforced plastics for transportation, construction, etc.; as a raw material for plasticizers; different formulations used for molding compounds; etc. 12 pages. A similar brochure deals with isophthalic uses in surface coatings. 12 pages. *Oronite Chemical Co., 200 Bush St., San Francisco, Calif.*—**End**

Plastics Digest

(From pp. 58, 60)

procedure is applicable to other materials that are sparingly soluble and thermally stable.

Chemistry

Reactions of polyphenols with formaldehyde. W. E. Hillis and G. Urbach. J. Appl. Chem. 9, 665-73 (Dec. 1959). Naturally occurring polyphenols were reacted with formaldehyde at various conditions of time, temperature, and pH. Greatest reactivity occurred at pH 8. Formaldehyde uptake was determined for several polyphenols at pH 8 for 3 hr. at 100° C. This technique gave good indication of the efficiency of the polyphenols as adhesives. The difference in behavior of these materials as adhesives, particularly in plywood, are discussed.

Some polyamides from dicarboxylic acids containing aromatic ether groups. G. J. Tyler and K. Whittaker. J. Appl. Chem. 9, 594-99 (Nov. 1959). Dicarboxylic acids containing one or more phenoxyacetic acid groups were condensed with either hexamethylenediamine or decamethylenediamine to yield high molecular weight polyamides. Experimental details for preparation of the acids and the properties of the polyamides obtained with them are reported and discussed.

Publishers' addresses

Analytical Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

British Plastics: Iliffe and Sons Ltd., Dorset House, Stamford St., London SE1, England.

Bulletin of the Chemical Society of Japan: No. 5, 1-chome, Surugadai Kanda, Chiyoda-ku, Tokyo, Japan .

Chemical and Engineering News: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Chemical Week: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York 20, N. Y.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Journal of Applied Chemistry: Society of Chemical Industry, 56 Victoria St., London SW1, England.

Journal of Applied Polymer Science: Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y.

Journal of Chemical Engineering Data: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Kunststoffe: Karl Hanser Verlag, Leonard-Eck-Strasse 7, Munich 27, Germany.

Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Plastics (London): Temple Press Ltd., Bowling Greene Lane, London EC1, England.

SPE Journal: Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.

Vysokomolekuliarnye Soedineniia: Academy of Science of U.S.S.R., Moscow, Russia—**End**

Photo courtesy Bergen Evening Record, Hackensack, N. J.

Plastics typewriter

(From pp. 92-95)

After the test mold was received and tested out, it was found necessary to change from a conventional (directly into the cavity) type to a tab type of gate to avoid stress areas and blush marks in the gate area. After this switch, the molded parts turned out very satisfactory.

Production molds

As a result of this experience, Remington Rand decided to tool up for the job. It was also decided that the side panels would be molded in a two-cavity combination injection mold—one cavity for each of the parts; the carriage end covers would be molded in a four-cavity combination mold—two cavities for each part; and that the top and back covers would be molded in individual single-cavity molds.

The carriage and cover molds were cut by Consolidated. The molds for the other parts were produced by Premium Die & Tool Corp., Jamestown, N.Y. Edge gating, using the tab type of gating, was provided for in all the molds. The gates were located at the approximate center of the side being gated, rather than at the ends of the piece, to give a more equal distribution of the material and reduce the length of flow.

The top cover mold has end slides on the core which move in dovetails. These go upward and inward and assist in ejecting the part. They are used to mold the interlocking feature of the cover which snaps into the side panels (a tongue-and-groove assembly). In addition to this, there is a front side action on the core side to mold the front recessed portion of the cover. This is necessitated by the angle at which the cover is molded. The cavities of these molds were made from air hardening steel while the cores were made of a pre-hardened steel.

Assembly and finishing

The side panels fasten to the chassis of the typewriter (a die cast metal frame and metal stampings) with dowels and screws; the top cover is a snap fit onto the side panels (using the tongue-and-groove assembly described above). The molds were built to allow for adjustment of those features that interlock during assembly; the chassis is also designed to allow for adjustment of the plastics parts so they can be aligned properly.

As far as finishing of the parts was concerned (the ABS housings are available in six different decorator colors), the side aprons on the side panels are sprayed in a contrasting grey color (that can attractively offset each of the decorator colors). The front recessed area of the top cover of the typewriter is also sprayed the same contrasting grey.

The parts are hand sprayed in conventional spray booths. No treating or degreasing of the parts before spraying is necessary; the only requirement is that no lubricant be used during the time of the molding operation.

After spraying, the parts are placed in portable drying racks. The name Quiet-riter Eleven is hot stamped on the right-hand side of the front recessed area of the top cover; holes are drilled into the left side to accommodate a molded plastic name plate.

The future

Although only out on the market a matter of a few weeks, the Remington portable has already stirred up considerable industry comment—and has met with enthusiastic customer acceptance. As a market in itself, the over 1 million portables sold yearly can account for a sizable share of plastics. More important, designers of standard size typewriters have been encouraged by the success of the portables to take a long, careful look at plastics—and who knows what is already being conceived on the drawing boards of U.S. typewriter manufacturers.

The typewriter has long held a position among consumer and industrial products as a symbol of quality and solidity. The acceptance of plastics by this product cannot help but have an important influence on the growing use of plastics in all products.—**End**

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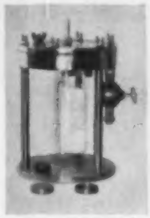
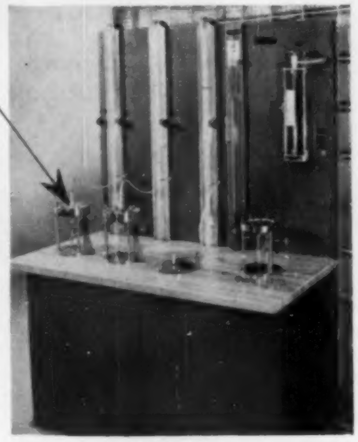


Model CS-89 Cell

The cell was developed to measure the gas transmission rate of plastic sheeting and plastic coated papers. The unit is designed to have all parts removable for cleaning and replacing. The manometer system of the cell is calibrated and adapters are furnished for fast and slow gas transmission rates. A typical three cell console is shown on the right.



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Literature and prices upon request

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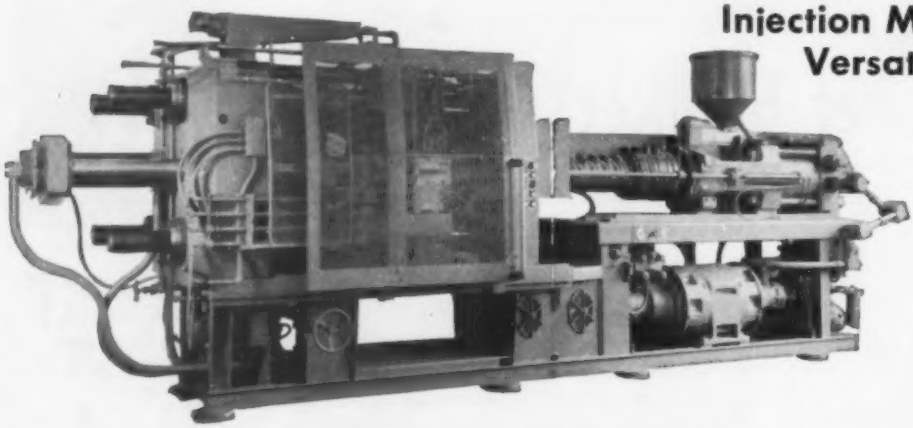

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Export Distributors: Omni Products Corp., 460 Fourth Avenue, New York, New York

Bearings

(From pp. 96-100)

slot. The design is such that precision bearings can be produced which eliminate the large clearances required with plain nylon bearings; that cannot seize due to expansion caused by water absorption or heat build-up; and that can be molded with thin, uniform walls which cool uniformly during manufacture and do not have undesirable locked-in stresses.

Compared with bronze bearings (which always require lubrication) in automotive uses, as just one example, Thomson bearings have shown an 800% longer service life . . . at a 10% reduction in initial cost, according to information from the company.

There are at least four other materials which have properties that make them potential competitors in the wide-spread bearings market. These are included in Table I for quick comparison of characteristics. They have been studied to some extent for bearing applications, but development work of this sort is always slow. It may be years before any of them reach great stature as bearing materials. Again for comparison purposes, and for a look into the future, some of the possibilities of these materials are included in the tabulation on p. 99.

Conclusion

Where shaft speeds are high, loads are heavy, and really high temperatures are the rule; where noise is not a factor, where vibration damping is not a function of the bearing, and where rapid bearing wear can be tolerated, metals will probably continue as the chosen bearing material. But for thousands of jobs where plastics bearings can do a better job, often at lower cost, they are being accepted in ever-increasing numbers. As more know-how accumulates, as formulations are developed to extend the service range of bearing materials, as designers become more aware of their possibilities, these numbers will continue to grow. The world rolls on bearings, and more and more of them are plastics!—**End**

Table I: Properties of plastics as materials for bearings*

Material	Phenolic laminate[a]	Molded PTFE[b]	Nylon	ABS[c]	Acetal[d]	Polycarbonate[e]	Chlorinated polyether[f]
Coefficient of friction, dry (as low as)	0.03[h]	0.016 to 0.26[j]	0.15 to 0.33[k]	0.2[l]	0.1 to 0.3	[m]	n. a.
PV value[g] (dry, as high as)	n. a.	1000[n]	7000[o]	n. a.	1600	n. a.	n. a.
Impact strength, Izod (ft. lb./in. of notch)	1.5 to 9.04[l]	3.6[n]	1.0	0.7 to 12	1.4 to 2.3	12 to 16	0.4
Thermal conductivity (10^{-4} cal./sec./sq. cm./1 °C./cm.)	4 to 7	6	5.2 to 5.8	1.46 to 8.6	5.5	4.6	n. a.
Thermal expansion (10^{-5}/°C.)	3.0 to 4.4	4.5 to 7.0[n]	10. to 15	6 to 13	8.1	7	8.0
Heat resistance, °F. (continuous)	300 to 350	500[n]	270 to 300	140-250	185-250	275	290
Water absorption (24 hr., 1/8-in. thickness, %)	0.3 to 2.5[p]	0.00	0.4 to 1.5	0.1 to 0.3	0.12	0.3	0.01

*Values or ranges of values are for basic materials and will vary greatly—especially in coefficient of friction and PV values—with changes in formulation, fillers, and operating conditions. Figures given are those on which there is most general agreement between material suppliers and end users, except as specifically noted.
[a]Cotton fabric base.
[b]Polytetrafluoroethylene.
[c]Acrylonitrile-butadiene-styrene copolymer.
[d]Du Pont's Delrin.
[e]General Electric's Lexan.
[f]Hercules' Penton.
[g]PV = load in p.s.i. on projected bearing area × surface velocity of shaft in ft./min.
[h]Water lubricated. American Brakeblok data.
[i]American Brakeblok data.
[j]Du Pont data.
[k]Thomson Industries data.
[l]Naugatuck Chemical data for Kralastic MM.
[m]Stated by General Electric to be "somewhat higher" than nylon and acetal.
[n]Du Pont data for pure molded Teflon. Modified PTFE materials show far higher values.
[o]Polymer Corp. of Pa. data.
[p]Synthane data.


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R_x for diversification

(From pp. 101-103)

ricating processes of the participating blow molders, consideration also had to be given to bottle neck tolerances. Fuller engineers coordinated close cooperation between the blow molders and the cap closure manufacturer, Poly Top Corp., Hingham, Mass., resulting in an agreed neck tolerance on all bottles of ± 5/1000 in. I. D. so that the polyethylene caps would actually fit any bottle. The caps contain two sealing rings on the inner cylinder and are designed for tight snap fitting.

Oil, lotion, and shampoo containers have two-piece swing-spout dispensing heads, the powder package a two-piece sifter cap, and the cream jar is equipped with a screw-on metal cap. Although the swing-spout dispensers are leakproof, a paraffin spray on the dispenser bearing of the oil container was necessary to prevent a slight seepage of the contents by capillary action.

The Gerber products story

This story really starts several years ago when Dow Chemical Co. began experiments with polyethylene formulations that would be bacteriostatic and bacteriocidal. Early this year, the company's efforts were crowned with success and it is now offering such resins under the trade designation Surfaseptic (the name derives from the fact that the bacteriocidal agent in the formulation continuously migrates to the surface of the product so that washing will not affect its activity for any length of time).

While research was going on at Dow, Gerber management was considering ways of entering the infant toy market. With its name firmly established as a quality symbol in the field of baby foods, the company felt it worthwhile to capitalize on this reputation and offer a line of toys specifically designed for that age bracket.

And while these two developments were going on, blow molding became a perfected and generally available technique.

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COMPOUNDING INGREDIENTS AND MANUFACTURERS. 4 technical data pages list compounding ingredients and their manufacturers in following categories; stabilizers, plasticizers, fillers, volatile diluents, blowing agents, surface active agents. Data on physical properties of a medium viscosity; PVC resin. Chemical Div., Goodyear Tire & Rubber Co. (E-002)

RIGID POLYVINYL CHLORIDE AND SHEET LININGS. 40-pages, assorted catalog material describes features, physical properties of PVC linings for processed tanks and vessels, storage tanks, exhaust hoods, etc. Kaykor Industries, Inc. (E-003)

VINYL COMPOUNDS FOR SHEATHING. 12-page technical bulletin describes features, properties, and applications of vinyl compounds for wire and cable sheaths. B. F. Goodrich Chemical Co. (E-004)

DYES, CHEMICALS, PROCESSES. 44-page brochure outlines technical services and facilities in dyes, dyestuff and chemical fields. New processes, exploration of new chemical markets. General Dyestuff Corp. (E-005)

SELF-TAPPING INSERTS. 12-page catalog describes features of self-tapping, self-locking inserts designed to provide strong threaded connections in plastics. Groov-Pin Corp. (E-006)

VERTICAL INJECTION MOLDING MACHINE. 10-page catalog describes a machine designed for injection, compression, injection-compression or transfer molding. Specifications. Improved Machinery, Inc. (E-007)

POLYESTER RESINS. 4-page brochure describes 6 new polyester resins, features and applications, designed for use in reinforced plastics fabrication. Interchemical Corp., Finishes Div. (E-088)

EPOXY RESINS. 18-page technical folder describes applications, properties of epoxy resins for the electronic industry. Specifications. Marblette Corp. (E-009)

ANTI-STATIC FORMULA. 6-page folder describes applications of anti-static wax and cleaner formula designed to clean clear plastic, prevent accumulation of static charges. Comes with free sample. Merchandise Presentation, Inc. (E-010)

ACRYLONITRILE-BUTADIENE-STYRENE PLASTIC. Describes applications of an ABS-plastic designed to provide injection molders with material having rigidity, dimensional stability, high heat resistance, etc. Naugatuck Chemical. (E-011)

OVEN FOR SOLVENT COATINGS. 6 catalog pages describe features and applications of radiant heat ovens designed for drying and curing of solvent coatings. Radiant Heat Enterprises, Inc. (E-012)

WETTING, DISPERSING AGENTS. 14-page brochure describes applications of wetting agents in solvent systems, dispersing agents and recommendations for use in ink formulations; a cationic polyamide stabilizer and surface active agent. Synthetic Chemicals, Inc. (E-013)

METAL FLAKE DECORATION. Illustrated 6-page brochure discusses the areas of use for colored metal flakes designed for laminating into plastic sheeting. The Dobeckmun Company. (E-014)

FIBREBOARD CONTAINERS. 4-page, illustrated folder describes line of fibreboard containers and tubing in various shapes and sizes. Specifications. Cleveland Container Co. (E-015)

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PLASTIC SCRAP GRANULATOR. Illustrated 4-page brochure describes a rotary knife plastics granulator for reducing thermoplastic scrap. Two models, with capacities of 100 to 200 and 200 to 400 lbs. per hour. American Pulverizer Co. (E-021)

COATINGS FOR VACUUM METALLIZING. 45-page booklet describes application and use of vacuum metallizing coatings which may be applied by spraying, dipping, and flow coating to thermoplastics, thermosetting plastics, metals, and glass. Bee Chemical Co., Logo Div. (E-022)

INDUSTRIAL RADIANT HEATERS. 15-page illustrated booklet provides product data on two types of industrial radiant heaters for drying, heating, baking and curing. Corning Glass Works. (E-023)

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SYNTHETIC DRY RUBBERS, LATICES. Describes features and applications of a line of synthetic dry rubber and synthetic latices. Firestone Synthetic Rubber & Latex Co., Div. Firestone Tire & Rubber Co. (E-027)

FIBER GLASS WOVEN ROVING. 4-page illustrated catalog folder describes features and applications of a line of fiber glass woven roving fabric designed for use in construction of such things as fiber glass swimming pools, large containers, boats, etc. Bean Fiber Glass, Inc. (E-028)

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PREHEATING AND DRYING OVEN. 4 illustrated catalog pages describe drawer type plastic preheat and drying ovens, designed to maintain proper moisture content control according to seasonal variations. Specifications, data. Despatch Oven Co. (E-031)

PELLETING MACHINERY. 4-page illustrated catalog folder describes machinery designed for compressing or densifying dry and low-moisture content, powdered, granular and fibrous material into pellets by extrusion. Specifications. Daffin Mfg. Co. (E-032)

VACUUM CLEANER HOSE. 10-page illustrated catalog describes features and applications of a new commercial vacuum cleaner hose designed for use in the plastics industry. Specifications, prices. Flexaust Co., Div. Callahan Mining Corp. (E-033)

HUMIDITY MEASUREMENT AND CONTROL. 74-page illustrated catalog describes features and applications equipment designed for precision humidity measurement and control; to prevent rust, mold, mildew, corrosion, and static electricity. Charts, specifications and tables, and prices. Hygrodynamics, Inc. (E-034)

SHEET STOCK TESTING INSTRUMENTS. 12-page brochure illustrates and describes thickness micrometers, burst strength testers, and basis weight scales for testing various physical and mechanical properties of papers, tissues, films, foils, boards, etc. Prices. E. J. Cady & Co. (E-035)

TAKE-OFF MACHINERY AND EQUIPMENT. 16-page illustrated catalog folder describes features and applications of a line of mechanical take-off machinery and equipment, specifications. Farris Universal Machine Corp. (E-036)

PREFORMED MOLDED FIBRE. A 24-page booklet describes properties, special features, applications of cellulose fibres made in combination with synthetic resin additives for packaging. Hawley Products Co. (E-037)

CORROSIVE AND ABRASIVE DISPENSER. 4-page illustrated brochure describes features and application of equipment designed for processing and dispensing of corrosive and abrasive reactive resin mixes. CPM Special Machinery Corp. (E-038)

ROLL LEAF MARKING EQUIPMENT. 6-page folder describes features and applications of both hand and power operated presses and other accessories used in roll leaf marking and stamping processes. Olsenmark Corp. (E-039)

MOLDING PRESSES. Illustrated 8-page brochure describes and gives general specifications for a line of automatic molding presses ranging from 60 to 450 tons in capacity. Choice of compression or transfer molding at a switch-turn. Baker Bros., Inc. (E-040)

PLASTICS CATALOGUE. 64-page catalogue lists data and specifications for various plastics like lucite, plexiglas, vinylite, polystyrene, nylon, fiberglas, acetate, mylar, etc. Plastics Div., of Kaufman Glass Co., Inc. (E-041)

INJECTION MOLDER. Technical data sheet describes a 3 & 4/6 oz., high-efficiency injection molding machine for insert work, cord plugs, grommets, strain-reliefs and second-color molding. Moslo Machinery Co. (E-042)

SMALL-PARTS HOPPER. Illustrated 6-page brochure describes a box and stand system which automatically supplies small pieces to a hopper for hand removal, as the box is set in place on the stand. Also shows roll-over, bottom dump and funnel type boxes. The Powell Pressed Steel Co. (E-043)

PLASTIC EXTRUSIONS. 4-page brochure describes service which features both standard stock shapes and custom-designed shapes for individual specifications. Rotuba Extruders, Inc. (E-044)

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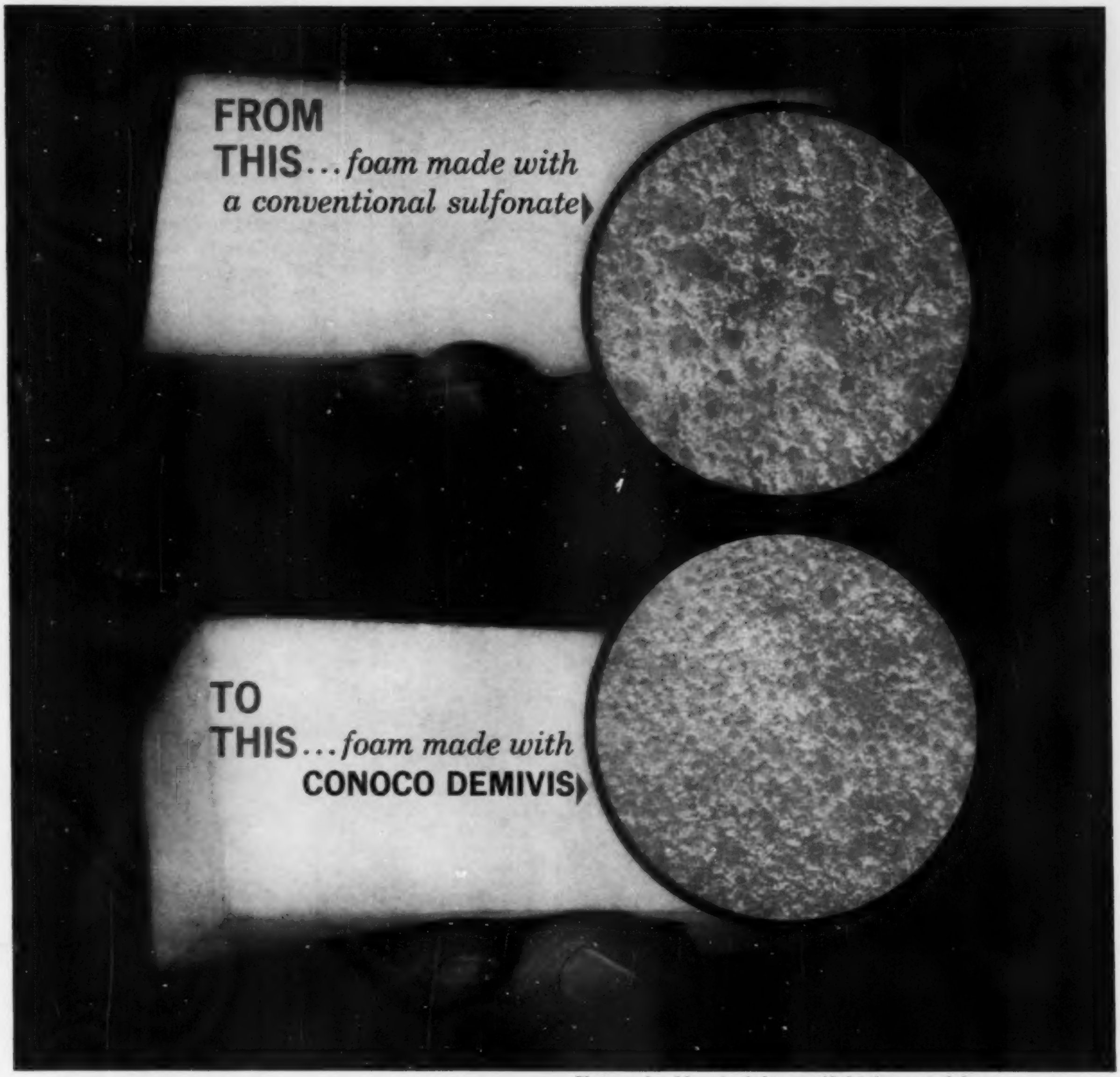

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mercial equipment and Dow's Surfaseptic polyethylene.

The Gerber toys are produced by Gerber Plastic Co., an affiliate of Gerber Products. At the present time, two machines are used, one a Diversamatic, made by Boston Plastic Machinery Inc. (now merged with Modern Plastic Machinery Corp.), the other an F. J. Stokes Corp. manifold blow molder. Both machines are of the extruder-blower type and use a manifold for two-station blowing.

The resin used for this application is a blend of 0.923 and 0.950 density to give an actual density of 0.940. Melt index is .7.

Several reasons are given by Gerber for choosing blow molding. According to Thomas R. Graham, general manager of Gerber Plastic, "for one of our toys, 'Willie Worm,' we investigated both injection and blow molding dies, and found that the former would have cost us $12,000. The blow molding dies on the other hand cost us only $2000."

Production, too, is more efficient. A basic Gerber item is a four-piece train. The blow molding machine uses two 2-cavity molds, each mold working on a 20-sec. cycle. The cars drop from the mold onto a tray, a workman strips off the excess parison in two quick movements, and, except for a brief reaming operation on one of the four cars, they are ready for final packing. Gerber can produce 10,000 a day, twice as many as it could have turned out using injection molding.

One interesting Gerber development is the hollow-doughnut-shaped toy. The problem with this particular item is to put the hole in it. It was solved by a pinching off and resealing operation, and a stacking ring and nut-and-bolt set are the first of those items to hit the market.

The plastics companies involved in these two programs are particularly pleased with at least one aspect of this interesting development: both Fuller and Gerber have long been identified with quality products. They can, therefore, be expected to maintain these high standards in their new lines—thus helping to establish blow molded items as quality products.—**End**

Structure versus

(From pp. 131-136)

laminates increased on aging at 400° F., suggesting that cure continued during heat-aging. The phenomenon also suggests that more drastic curing may be used to upgrade the epoxy-resin phenolic combination beyond the limits indicated in Table II. A laminate prepared with Resin A cured with boron-fluoride-ethylamine maintained a steady strength value for the duration of heat aging tests; about the same behavior was noted with or without added hydroxylic compound to promote cure.

Acknowledgment

The authors wish to acknowledge the assistance given them by R. P. Kurkjy, H. R. Guest, and B. F. Kiff, Research Department, Union Carbide Chemicals Co., in the preparation of some of the polyphenol intermediate compounds, and by P. A. Thomas and J. L. Welch, Development Laboratories, Union Carbide Plastics Co., in the evaluation of many of the experimental resins.

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Spot tests

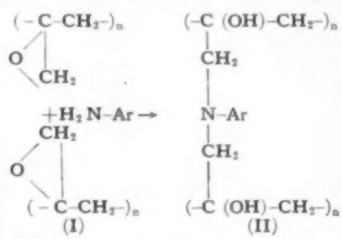
(From page 151)

resins that contain a phenol or amino component (phenol-formaldehyde or cross-linked epoxy resins) are evaporated with fuming nitric acid, the phenol or aniline initially split off (the latter with cooperation of nitrous acid) are converted to polynitrophenols which, as stated above, do not yield any phenol when pyrolyzed. Therefore, the test given here is characteristic for styrene resins as well as styrene-containing mixed polymers (for example, styrene-butadiene polymer).

Procedure: A little of the sample is taken to dryness with four drops of fuming nitric acid (sp.gr. 1.5). The residue is heated directly in the micro test tube over a flame. It is well to start the heating at the middle of the test tube and progress downward. The remainder of the procedure is as given under "Plastics containing phenol," as described above.

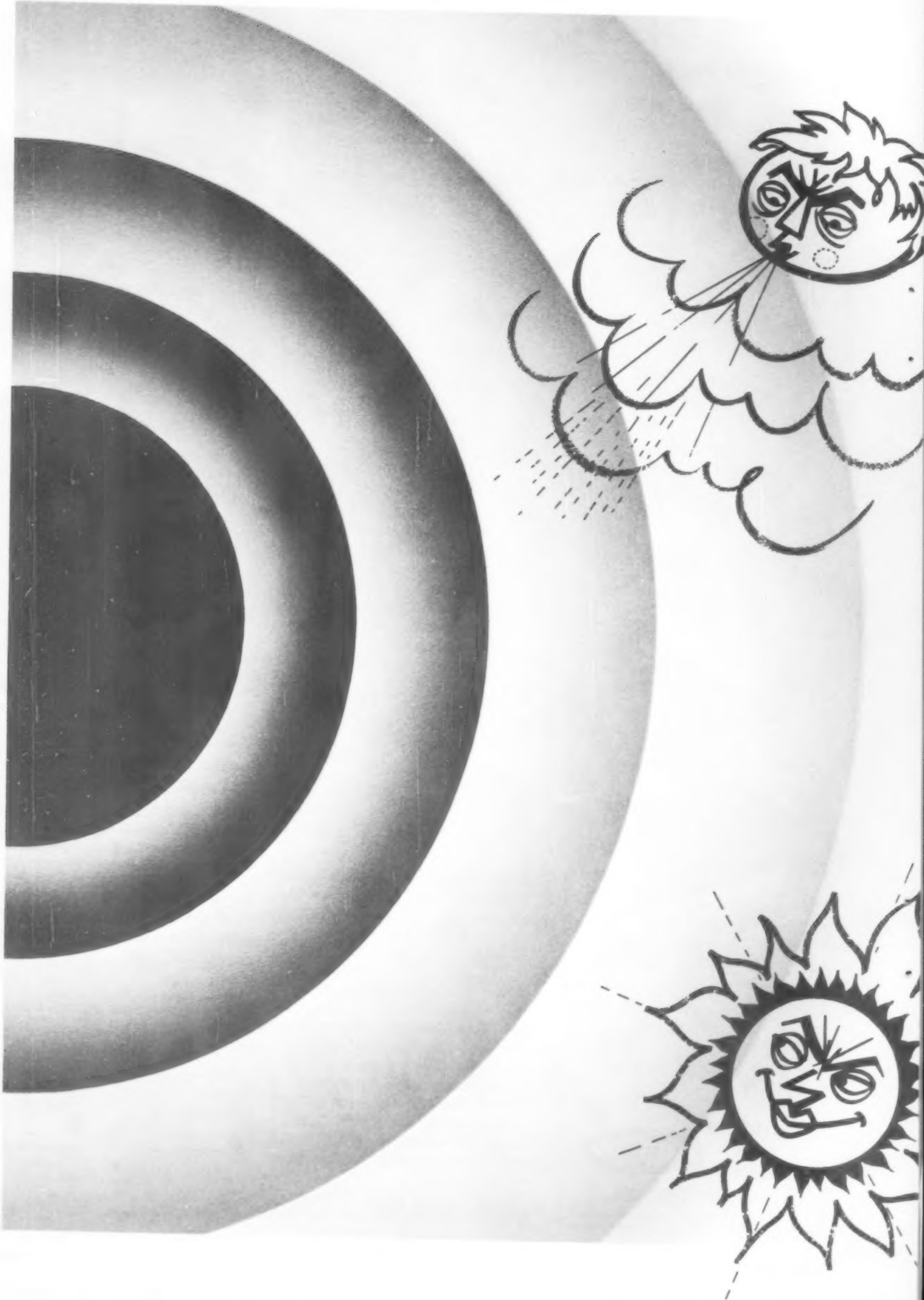
Epoxy resins

Noncrosslinked epoxy resins (I) and epoxy resins that are crosslinked with primary aromatic amines (II) are polymers with the following schematic structures:



These polymers on ignition split off acetalydehyde or homologs of acetalydehyde, a behavior similar to that of cellulose. However, if the temperature does not go above 240° C., the pyrolytic splitting off of aldehyde occurs *solely* in the case of epoxy resins. Because of this limitation, epoxy resins, either crosslinked or not, can be specifically detected by means of the blue color given by the aldehyde in the gas phase when the vapors come into contact with sodium nitroprusside containing some amounts of piperidine or morpholine (8).

Procedure: A sample of resin or of fabric impreg- **(To page 194)**



nated with it is heated to 240 to 250° C. in a glycerol bath. The open end of the micro test tube is covered with a disk of filter paper moistened with a freshly prepared water solution containing 5% each of sodium nitroprusside and morpholine. A blue color appears if epoxy resins are present.

Crosslinked epoxy resins that are condensed with aromatic amines conform to the rule that aromatic compounds bearing oxygen in the side chain yield phenol when pyrolyzed (6). The latter can be detected in the gas phase by reaction with 2,6-dichloroquinone-4-chloroimine and ammonia, as previously described. Consequently, after making the aldehyde test, it is possible to distinguish between crosslinked and noncrosslinked epoxy resins.

Differentiation of chlorinated rubber and chloroprene

It has been reported (9) that compounds containing CH_2Cl or $CHCl_2$ groups yield sulfur dioxide when dry-heated with sodium thiosulfate to 180° C. The first case involves the formation as well as the pyrolysis of the so-called Bunte salts:

$$RCH_2Cl + Na_2S_2O_3 \rightarrow NaRCH_2S_2O_3 + NaCl \quad 1.$$

$$2\,NaRCH_2S_2O_3 \rightarrow Na_2SO_4 + RCH_2SSCH_2R + SO_2 \quad 2.$$

Compounds containing the $CHCl_2$ group probably undergo the following reaction:

$$RCHCl_2 + Na_2S_2O_3 \rightarrow RCHO + 2\,NaCl + S + SO_2 \quad 3.$$

Accordingly, the realization of reactions 1 to 3 (shown above) leading to sulfur dioxide makes possible the detection of reaction-capable chlorine compounds.

It has now been observed that chlorinated rubber, in contrast to chloroprene, yields sulfur dioxide when heated with sodium thiosulfate. The reason clearly is that the chlorination of rubber not only adds chlorine to the double bonds but in addition brings about a degradation through a shortening of the carbon chains, with formation of new terminal members containing CH_2Cl and $CHCl_2$ groups. In contrast, synthetic chloroprene rubber (Neoprene), which is produced by polymerization of 2-chlorobutadiene, contains only

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C(Cl) or CHCl groups, which do not, of course, react on contact with sodium thiosulfate.

Procedure: A small quantity of the sample is mixed with several cg. of sodium thiosulfate and the micro test tube is placed in a glycerol bath that has been preheated to 80 to 100° C. The temperature is gradually raised. After the thiosulfate has been dehydrated at about 150° C., the mouth of the test tube is covered with a disk of Congo paper moistened with 3% hydrogen peroxide, and the bath is then brought to 170 to 180° C. If chlorinated rubber is present, the indicator paper is turned blue by the released sulfur dioxide.

Another procedure for distinguishing chlorinated rubber from chloroprene is based on their behavior when heated to 200 to 210° C. Chloroprene yields considerable hydrogen chloride, as compared to the slight amount given off by chlorinated rubber. This difference is especially distinct if the test material is heated for about 10 min. at 210° C. in the glycerol bath. The gaseous hydrogen chloride is then expelled by blowing into the micro test tube through a pipette, and the open end of the test tube is covered with moistened Congo paper as before. Only Neoprene will then yield additional sulfur dioxide at 190 to 200° C. as shown by a blue stain on the indicator.

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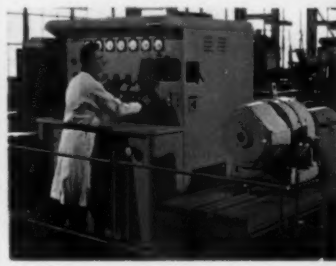

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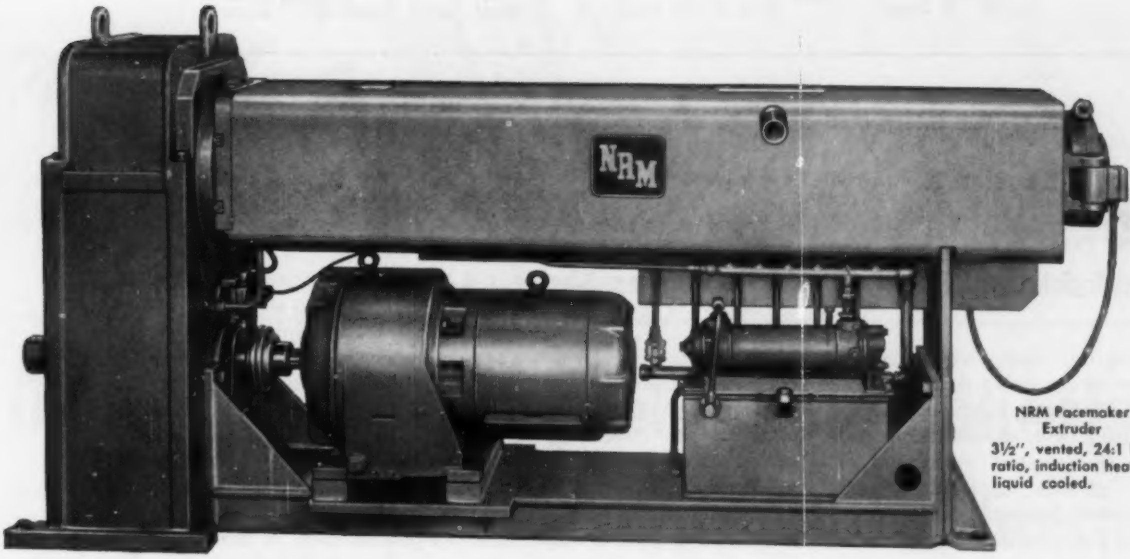

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News and interpretations of the news By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 41)* **May 1960**

Highlights and trends at the Packaging Show

A first-time visitor or casual observer at the recent Atlantic City, N. J. Packaging Exposition might feel that this show was loaded with the greatest assortment of new plastics applications and ideas ever presented to the packaging industry. Old timers, on the other hand, may have muttered "just more and more of the same old thing." There's validity to both views. But just like every other year, the most obvious were not necessarily the most important developments.

It is easy to recollect when polyethylene film, vacuum forming, skin packaging, and other such outstanding developments were first introduced at packaging shows. In each case they were displayed in a limited area with their potentialities not then fully realized. Today those infants of a few years ago are dominating factors at every packaging show.

Among all plastics materials in packaging, polyethylene film continues to create the most attention for the one good reason that it continues to expand into new markets every year.

An example is polyethylene bread wrappers. PE wrappers have been on trial for more than a year, and there were many exhibits featuring this item at the show. But it is doubtful that more than 5 or 6 million lb. of film are now being used for this purpose. Yet there is a potential of 50 or 60 million lb.—maybe more.

One of the reasons why progress is slow is that wrapping equipment now available is not adequate for the large-scale bakers. Smaller-volume bakers are using polyethylene to some degree; it is easier for them to superintend the technical problems involved in wrapping. The big baker, however, wants a machine that doesn't require technical experts to operate it. And because of the difficulties he has already had, he will be harder to persuade when satisfactory equipment is available.

But this problem of bread wrapping should soon be solved. Machinery, film, and bakery people now know what must be done, but there are few machines available built particularly for this job. One of the essential necessities is a sealing range of 100° F. Machines now using attachments permit a range of only 30°. When the wider range is established, it is probable that conventional film as well as medium and high density can be used, depending on whether the baker wants a "soft" or "hard" surface.

A similar case is polyethylene wrappers for cigarettes. Up to now there has been difficulty in opening a package encased in polyethylene. A machine was exhibited at the show which attaches a cellophane tear strip to eliminate the opening problem. The question of flavor escape has not yet been thoroughly tested. Cigars, too, are reportedly being wrapped in polyethylene by one producer, but in this case loss of flavor through film walls may be even more pertinent than in cigarettes and no information was available on the type of wrapping machine that might be used. These applications have potentials in the 20- or 30-million-lb. range, but the "when" and "if" are the big questions that arise at this particular moment.

Easier sealing seems essential to broaden markets for polyethylene film. A step in this direction was one film producer's showing of a low-melting-point adhesive (just above 150° F.) applied in a band from perforated rolls. A melting point so far below that of most thermoplastics is obviously much easier to handle by the packager since there is little danger of weakening the film. This principle of developing a coating that can be applied at a much lower temperature than the melting point of film was a highly important step in the volume increase of cellophane. This low-melt adhesive could be one of those "key" discoveries that could add great impetus to PE sales.

Another idea along the same line was the preliminary introduction of an ink for polyolefins that can be applied without pretreatment of the material to be printed. There have been inks introduced for this purpose before, but their performance has allegedly not lived up to their claims. The producer of the new ink asserts that his product is different from all others and, although modest in his claims of performance, is convinced that it will eventually prove satisfactory.

For a novel idea that will sell more film, the incorporation of "fragrance" in the film itself is in the top bracket. The several displays of this material at the show attracted almost universal attention. A film extruder can now buy master batches of scented resin and incorporate it in his film with a ½ to 2% of Poly-Scent mixture. Chocolate for candy boxes, orange scent for fruit, Chanel #5 for lingerie or stocking wraps, and various others are available. Such scents as cake or fresh bread odors are possible. Most emphasis was placed on a "clean" smell to be used for wrapping linens and other fabrics. The same fragrance can be incorporated in resin for garbage cans, dishpans, and other molded houseware items. Various large orders for scented film have already been reported, but the customers ap- **(To page 204)**

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Completed laminations made with BONDMASTER L368 combine optimum bond strength with excellent resistance to worming and delamination.

APPLICATION

May be applied by engraved or knurled rolls as well as smooth rolls (both reverse and direct). Conventional techniques involve oven-drying at 180°-220°F for 30-60 seconds, then combining between squeeze rolls at speeds up to 200 feet per minute (polyethylene/cellophane and polyethylene/"Mylar" laminates).

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BONDMASTER L368 is but one of a series of BONDMASTER adhesives specifically formulated for such mass production lamination applications as: acetate-to-foil packaging; phase and layer insulation laminates; bottle cap liners; metallic yarns; barrier wraps; etc. Write for individual Data Sheets applying to your current laminating problems.

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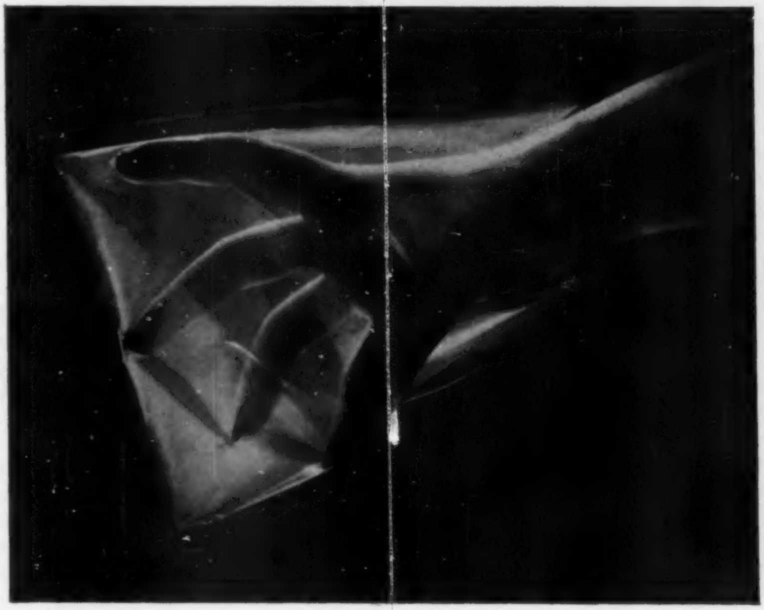

Since this new, odor-free laminating adhesive was originally developed for flexible vacuum packaging applications, it was formulated to be color-free in a thin film and to maintain exceptional color stability. As a result, laminations made with BONDMASTER L368 have been widely used, with excellent results, to package cheeses and other "sensitive" food products.

Because it provides a good balance of solids and viscosity, it combines optimum bond strength with excellent resistance to "worming," "tunnelling," and delamination when laminates are subjected to high and low humidity and temperature cycles as well as to prolonged exposure in food freezers and refrigerators. In addition, users report complete elimination of shrinkage problems in cellophane/polyethylene-laminate heat-sealable bag manufacture.

MULTI-PURPOSE USE

BONDMASTER L368 offers outstanding production speed and savings in the mass production laminating of treated and untreated polyethylene film to cellophane (plain and printed); saran-coated cellophane; "Mylar" (plain and printed); and saran-coated "Mylar." It is also recommended for laminating aluminum foil and other flexible films, foils, papers, and fabrics.

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THE PLASTISCOPE

(From page 202)

pear to be bashful concerning use of their names.

Among the fastest growing applications for PE during the last two years has been its use as a coating material on paper and paper board. Most of the coating has been done by the extrusion process using conventional resins, some of which have been 0.935 density or more. Some coating, however, has been done by the hot-melt process, using low-molecular-weight resins. With the introduction of a modified Steinemann curtain coater, there will probably be an increasing interest in hot-melt coating. The Steinemann was originally built as a lacquer coater for metals, but modifications make it possible to apply an extremely thin coat of polyethylene on paper, ranging from tissue thin to thick paper board used in shipping cartons. It is extremely useful for cut sheets and short runs. There is no waste of resin which can be used with or without modification—the formulation can be made to suit the job with use of extenders helping to cut costs. Freezer wrappers are a good prospect for this system. Advantages over paraffin are said to be improved grease resistance, scuff resistance, as well as non-flaking characteristics.

Paper coated with a high-density resin, for use in multi-wall bags, was another important new item at the show. A very thin layer to help cut costs and still maintain good barrier properties is a significant factor that will help high-density polyethylene move into the heavy duty bag field to compete with non-plastic, low-cost materials such as asphalt. Another angle of the heavy duty bag field is the 5- or 6-mil high-density copolymer polyethylene material that can apparently be easily sealed and is less expensive than the 10-mil conventional resin bag which was featured at the show a year or two ago.

The problem of sealing heavy sections brings to mind one processor who was carrying in his pocket a 12-mil conventional polyethylene bag that he claimed he could seal without trouble. The same man was exhibiting a phenolic coated polyethylene film used for carrying metal parts in an oil bath.

High-density polyethylene has made its greatest showing this year in blown bottles for detergents and in quart or 2-qt. containers. This application has had a mountain of publicity which took the edge off its novelty, but it is still new and was one of the outstanding features of the show. There were also some molded bottle caps in high-density polyethylene with a slight inner membrane seal that eliminates need of a liner. There will be thousands of these in the future—they can be molded with a threaded screw that holds up under use in contrast to conventional polyethylene where the screw is inclined to give after it has been used a few times. The high-density caps can be stripped from the mold without the need for unscrewing.

Another high-density application was containers for frozen food with a 10- to 15-mil bottom and 4- to 6-mil top in which frozen food can be boiled and which are easily opened when ready to eat. An automatic machine which will seal these frozen food trays by impulse rather than the bar seal, which leaves an irregular edge, has been installed by a producer who will use it to help customers develop markets. It is claimed that 1000 packages can be made on this machine at from \$15 to \$30/M, compared to conventional paper and overwrap containers at from \$11 to \$15.

Polypropylene producers were exhibiting rolls of what appeared to be excellent, strong and clear film. They are not yet making claims that polypropylene film has been widely applied, but they insist that the major problems of extrusion have been largely overcome and limited quantities are now being sold for wrapping bread, paper products, and textiles. An extruded container for deodorant sticks and molded bottle caps were also on exhibit. Polypropylene is still in limited supply, but experimental items are around in quantity—it seems safe to wager that next year's show will find propylene film and molded items in great abundance.

Polystyrene in volume. There was probably more polystyrene at this year's show than ever before. The puzzle of how 75 or 80 million lb. of polystyrene could be used in packaging is answered. Containers and boxes of every description were in evidence everywhere and most of these individual items are made in the millions. Examples are boxes for fish lines, 20 oz. food containers, vials, bundle packages, lids, lipsticks, etc. A comparatively new one was a Mentholatum jar which indicates that styrene materials may broaden out in the lotion or salve business, provided each item is fully tested for migration ahead of time. An important trend was that toward decorated containers that can go straight from the grocer to the dining table with such products as cottage cheese, dressings, sour cream, etc. Polystyrene film for packaging stockings, paper products, textiles, windows in frozen food packages, etc., is on the increase.

Polystyrene foam for packaging was one of the outstanding new developments at the show. It is estimated that more than 10% of all the expandable polystyrene bead production now goes for packaging or perhaps 4 to 6 million lb., which is a lot of growth in one or two year's time. It was even shown by one extruder in thin sheets, about the same thickness as book paper. Another extruder is furnishing it in a bit thicker form with a sparkling satin finish that can be used for toys as well as packaging. From foam drinking cups and extruded foam on a styrene film from which cups can be made to huge typewriter shipping cases and large boxes for shipment of fragile items, the material was evident in scores of booths. It has taken several years for this development to blossom, but it made big talk in the trade at this meeting.

Acetate and butyrate were present for film **(To page 206)**

(From page 204)

containers and vacuum formed packages, etc., but a new development is an acetate-polyethylene laminate for blister packaging. According to producers it has already proven superior to other blister packs. It can be bonded to ordinary cardboard without pretreatment of the board, thus saving cost. It is porous enough so that a vacuum can be pulled through it as was exhibited in skin-packaged combs where the material pulled through the interstices and over each tooth.

There was also the usual amount of vinyl. Extruded, plasticized, thin, FDA-approved film is now being run on cartoning machines at a rate which is claimed to make it less costly than other skin packs. It is used for paper products, books, window curtain rollers, textiles, and for bacon or luncheon meats. The producer has recently increased his capacity. The same producer also claims that Pliofilm, a plastic made from rubber, is now in use for packaging red meats in practically every major food chain store in the country.

Other vinyl uses were bottles made from unplasticized sheet made by a process claimed to be simpler than blow molding; extruded tubes with injection molded tops for shampoo, oil, and other products that "walk through" most other thermoplastics; cast ½-mil film which is moving rapidly not only as a household wrap but for phonograph album wrappers and in bundle packaging; clear and opaque extruded film, both plasticized and unplasticized in thicknesses from ½ up to 20 mils, which is being used for vacuum forming; coated glass aerosols; vinyl coated paper for cups, cap liners, containers, etc.

No account of the meeting would be complete without an accolade to Monsanto for a unique presentation of its products in a booth where customers could push a button and receive a typewritten card on which was printed pertinent data on any one of the company's display of several hundred samples of items made from its material. It was also possible for each person at the booth to tune in on conversations between visitors and company spokesmen who answered questions as they were asked by any person who was interested.

Space does not permit a report on all the details of the show. This highlight summary is pointed more toward new and increasing trends that will take up more space at shows in the future.

Broad uses for ketones

Condensed ketones, designated MR-77, based on an aliphatic ketone, and MR-85, based on an aromatic ketone, are now available from Mohawk Industries Inc., 44 Station Rd., Sparta, N. J. These ketones are said to be compatible with most of the film forming resins and latices used in coatings and adhesives. They are currently being used in vinyl solution formulations for coatings on plastics, metals, paper, and textiles; in flexographic, rotogravure, and heat-set inks; in various cellulosic-based coatings and adhesives; and in many of the synthetic latices used for coatings and adhesives.

Plastisol for bellows

A free-flowing liquid vinyl dispersion, designated No. 9225 Denflex Plastisol, is offered by Dennis Chemical Co. Inc., St. Louis, Mo., for molding products which are highly wear-resistant and flexible at low temperatures. The formulation, which is also said to be resistant to gasoline and oils, is suggested for bellows, grease boots, sleeves, hoods, dust covers, seals, visors, convoluted tubes, and intricately shaped objects. Processing consists of dipping and fusion by heat.

Summer courses

Special summer programs at Massachusetts Institute of Technology, Cambridge, Mass., include "The Strength of Plastics and Glass," which will be held from June 20 through June 24. Similarities and differences between these two materials with respect to strength and fracture behavior will be the principal focus of this program. In several instances, new and as yet unpublished research will be presented. Also at M.I.T., "Fundamentals of Adhesion" will be dealt with in a program scheduled for June 27 through July 1. These programs will be presented by the M.I.T. Plastics Research Laboratory under the general direction of Prof. Albert G. H. Dietz. Tuition for each program is $200. Academic credit is not offered. Sessions will be held mornings and afternoons.

An intensive one-week course on the "Organic and Physical Chemistry of Macromolecules" will be held at Polytechnic Institute, 333 Jay St., Brooklyn, N. Y. from August 29 through September 20. The program includes preparation and kinetics of polymerization of high polymers. Both classical and recent techniques will be developed. Classes begin at 9:00 a.m. and end at 9:00 p.m., and include both lectures and laboratory work. Tuition is $150. Attendance is limited to 30 persons. Inquiries should be addressed to Mrs. Doris Cattell at the Institute.

Outlook for giant molecules

A glimpse into the future of plastics was presented by Prof. Herman F. Mark of Polytechnic Institute, Brooklyn, N. Y. Speaking at a dinner of the New York Section, American Chemical Society, where he received the Section's 1960 William H. Nichols medal, Dr. Mark pointed out that the era of molecular engineering now in full swing is characterized by the daily appearance of new polymers which satisfy old demands at lower costs and in improved manner, and expand their applications into entirely new and highly practical fields.

Plastics will be available which do not melt, even when they are red hot, and which do not shatter even when they are hit by a bullet. On the drawing board of the polymer chemists are insulating materials which will transport electricity at voltages 10 times as high as those (To page 208)

Dow Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

STUDIES OF GAS PERMEABILITY GIVE VALUABLE DATA ON MOLDING AND PACKAGING MATERIALS

Plastic barrier films often must have a specific resistance, or lack thereof, to gas and vapor passage, such as in the packaging of aerosols, carbonated beverages, and foods. Data on gas permeability, provided by Dow Plastiatrics studies, will be of value to plastics engineers and designers in the selection of proper barrier materials for use under known environmental conditions.

In the process of permeation–involving solution of the gas in the barrier material, diffusion through the barrier, and escape as a gas from the opposite side–permeability (rate of gas passage through a barrier of unit thickness) is a function of the diffusion rate and solubility of the gas in the barrier. Variables which affect permeability include temperature of the system, composition of the barrier, and size, shape and configuration of both the barrier molecules and gas molecules.

The general equation for gas transmission through a barrier is:

$$R = \frac{\overline{P}\, A\, \Delta p}{d}$$

where R = Maximum allowable gas transmission
$\overline{P}$ = Coefficient of gas transmission
A = Transmission area
Δp = Pressure differential across barrier
d = Thickness of barrier

This equation may be used to specify or evaluate the degree of resistance to gas passage obtained from a plastic material. However, $\overline{P}$ of the material must be measured experimentally. For example, $\overline{P}$ data for Saran Wrap* 7 and for Dow Polyethylene 610M are plotted on the basis of

$$\frac{\text{cc} - \text{mil}}{100 \text{ in.}^2 - 24 \text{ hrs.} - \text{atm.}}$$

in Figure 2.

Different sets of units are found in existing literature on permeability, and Figure 1 provides conversion factors for reducing the various units to common values.

Continuing Plastiatrics studies by Dow Plastics Technical Service Engineers are constantly developing new data on gas permeability of Dow packaging and molding material. For further information on these studies, write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1800CS5.

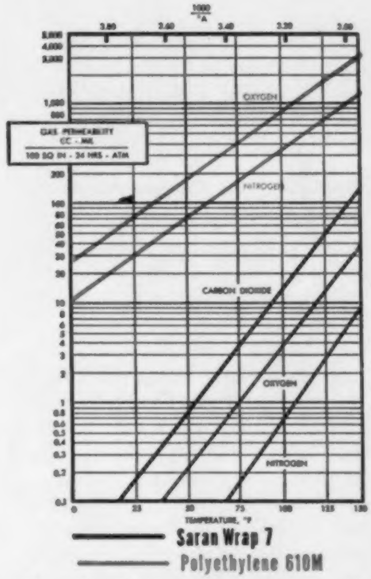

Fig. 2 Coefficients of Gas Transmission of Saran Wrap 7 and Polyethylene 610M, for various gases and temperatures.

AMERICA'S FIRST FAMILY OF THERMOPLASTICS

Styron® • Zerlon* • Ethocel® • Tyril®
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Fig. 1 Conversion factors for reducing permeability units to common values.

TO OBTAIN	MULTIPLY cc-mm / m²-sec-cm Hg	cc-mm / m²-sec-atm	cc-mm / m²-24 hr-atm	cc-mil / 100 in²-24 hr-atm	cc-mil / m²-24 hr-atm	cu in-mil / 100 in²-24 hr-atm
cc-mm / m²-sec-cm Hg	1.0	1.32×10^{-2}	1.52×10^{-7}	6.00×10^{-8}	3.87×10^{-9}	0.98×10^{-6}
cc-mm / m²-sec-atm	76.0	1.0	1.16×10^{-5}	4.56×10^{-6}	2.94×10^{-7}	7.47×10^{-5}
cc-mm / m²-24 hr-atm	6.57×10^{6}	8.64×10^{4}	1.0	0.39	2.54×10^{-2}	6.45
cc-mil / 100 in²-24 hr-atm	1.67×10^{7}	2.19×10^{5}	2.54	1.0	6.45×10^{-2}	16.4
cc-mil / m²-24 hr-atm	2.58×10^{8}	3.40×10^{6}	39.4	15.5	1.0	2.54×10^{2}
cu in-mil / 100 in²-24 hr-atm	1.02×10^{6}	1.34×10^{4}	0.16	6.10×10^{-2}	3.94×10^{-3}	1.0

See "The Dow Hour of Great Mysteries" on NBC-TV

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

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used today and others with the aid of which motors and dynamos can be operated at 800 to 1000° F. Improved types of coatings will protect space ships on their journeys against radiation and will help solve the re-entry problem of rockets and missiles. Integral parts of computers and electronic translation devices will have to be made from transformed synthetic polymers, which will make possible new combinations of the conductivity of electricity and heat in different directions.

Resists high temperatures

Non-woven asbestos felt saturated with phenolic resin and an inorganic filler is being used in compression molding of components that must withstand high heat and pressure. Called Thermomat, the felt is manufactured by Johns-Manville Corp., for one-piece lay-up in slabs 14 in. wide, approximately 12 ft. long, and 3/16 in. thick. Flexible before curing, tough and rigid after it is cured, the material is said to offer good resistance to physical abrasion and erosion in missiles and rockets during the ablation process. It also offers resistance to flame erosion in high temperature service, the company states. In a typical missile application, Thermomat, fabricated in a 1/8-in. thickness, protected the metal casing of a solid fuel compression chamber operating at 5000° F. for approximately 90 seconds, in an area with no flame erosion.

According to the company, typical physical properties of Thermomat 179 (with a 40 to 45% solids content of phenol formaldehyde resin) indicate a density of 106 lb./cu. ft., shear strength of 25,300 p.s.i. The material is available in a variety of styles, with varying resin, asbestos fiber, and additive contents to allow fabrication of components with the final properties required for specific applications.

A typical low pressure cure cycle for Thermomat is 300° F. at 100 p.s.i. for 15 min. for each 1/4-in. thickness of finished material. For higher pressures the mold temperature and duration of pressing time remain the same. Post curing is recommended and a typical cycle for a low pressure molded piece is at least 16 hr. at 300° F. In some cases it may be desirable to complete the post-cure at 500° F. for at least 3 hours.

Plastics in construction

The needs which plastics and chemicals may be able to fill in the construction field will be discussed by leaders of that industry at the 20th anniversary meeting of the Chemical Market Research Association, to be held on May 18 at the Biltmore Hotel, New York, N. Y. The program is designed to interest builders, architects, decorators, and officials concerned with city planning and building codes. J. E. Sayre, Allied Chemical Corp., president of the Association, has issued a general invitation. Registration may be made on the day of the meeting or in advance through C.M.R.A., 100 Church St., New York 7, N. Y.

Nonwoven fibers for plastics

A new division of Borlan Corp., New York, N. Y., has been formed to produce Flexlan nonwoven fibers for industrial applications, including backing for vinyl and other plastics products. Currently nylon, Dacron, acetate, and rayon are used to provide tensile strength and resilience for specific end uses. The thicknesses of Flexlan nonwovens range from 7 to 69 mil, and fabrics are available in 40-, 54-, and 58-in. widths.

Lowers plasticizer prices

A reduction of 1¢/lb. for Paraplex G-62, G-61, and G-60 plasticizers has been announced by Rohm & Haas Co., Philadelphia, Pa. The price for Paraplex G-62 is now 33¾¢/lb., and for the other two grades 32¼¢/lb. in bulk.

The G-series resins are high-molecular-weight epoxidized plasticizers, which are widely used in the vinyl industry. Their properties are said to include heat and light stability; good soap and detergent resistance; chemical stability; resistance to migration; and low volatility loss.

Fiber-resin insulation

A new class of flexible electrical insulating materials based on synthetic fibers in combination with compatible plastics resins is announced by Rogers Corp., Rogers, Conn. Developed to meet requirements for chemical and temperature resistant insulation that is less bulky but affords greater protection than existing materials, the plastic fiber-resin sheet insulation is produced by paper-making methods.

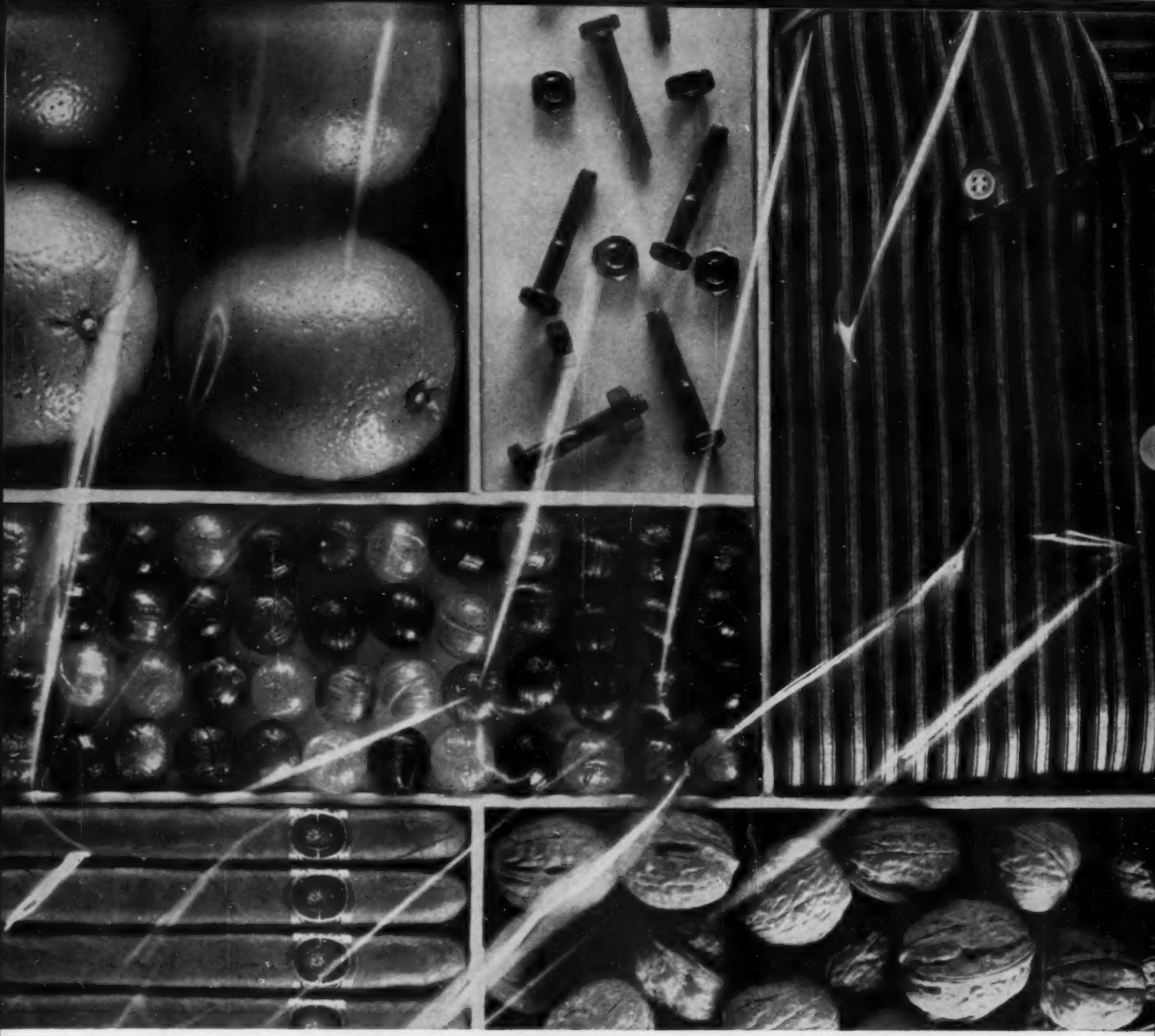
Duroid 2100 is the designation for the first of these new materials. This product, a combination of acrylic (Orlon) fibers and an acrylic resin, is intended for hermetic applications where resistance to Freon-oil mixture is a requirement. It is currently being produced in 13-in. wide rolls, in thicknesses from 0.010 to 0.030 inch. Thinner gages and laminated sheets are under development.

British PE copolymers

Three new types of Rigidex high-density polyethylene have been added to the range of materials marketed by British Resin Products Ltd., London, England. They are copolymers of ethylene with other olefins, and are designed for use in applications where better resistance to stress-cracking and superior load-bearing properties are required. In general, the new materials have a slightly lower heat distortion point and tensile strength and they are more flexible than the homopolymers.

Type 3, which has the best mechanical properties, has a melt index of 0.3; impact strength of 10.0 ft.-lb./in. notch; elongation at break of 300% and resists stress-cracking for 300 hours. Although designed primarily for extrusion, this grade of copolymer can be injection molded in smaller industrial items where surface finish is not critical. It is suggested for blow molded bottles, blown film for boilable packages, cable insulation, monofilaments, and industrial moldings.

Type 12 has an MI of 1.2; impact strength of 3.5; elongation at break of 200%; **(To page 210)**



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and resists stress-cracking for 100 hours. This type, which combines good processibility with good stress-cracking resistance, is suggested by BRP for injection molding where reasonable flow properties combined with good impact and stress-cracking resistance are of importance. It can also be used for extrusion.

Type 40 has an MI of 4.0; impact strength of 2.0; elongation at break of 150%; and resists stress-cracking for 18 hours. It is suggested for injection molding where very good flow properties, combined with fair stress-cracking resistance are required.

All three types have a density of 0.95; tensile strength of 3200 p.s.i.; and a heat distortion point of 239° F. at 30° deflection and 253° F. at 60° deflection.

Sinclair-Koppers Chemical Co.

A new plant for the production of styrene monomer will be erected at Houston, Texas by Sinclair-Koppers Chemical Co., a new corporation jointly owned by Sinclair Oil Corp. and Koppers Co. Inc. Completion and initial operation of the plant is expected by the middle of 1961. Sinclair Refining Co., an operating subsidiary of Sinclair Oil Corp., will supply the raw material for the new company, and Koppers will use or market the styrene output, which is estimated to be 70 million lb. per year.

Inflatable structures

Dome-like shelters made of flame resistant, vinyl-coated nylon are being built by Seattle Tent & Awning Co., Seattle, Wash., as enclosures for construction sites to protect workmen from the elements; domes over outdoor swimming pools; and coverings for tennis courts, exposition sites, and playgrounds. Called Air:Seal airhouses, the structures are supported solely by air pressure, have no interior props or poles, and reportedly can be erected, or removed for storage, in two to three hours. They are designed to withstand adverse temperatures, near hurricane force winds, and other extreme climatic conditions, the company states.

Bonded film lubricant

Permanent lubrication of all types of thermoplastics parts is said to be possible with Poxylube 42, a solid film lubricant with an epoxy resin base. Developed by Poly Chem., Indianapolis, Ind., for use in critical military applications where normal oil-based lubricants proved inadequate, the new product can be applied by spraying, dipping, and brushing. Although designed for use without curing, the solvent resistance and hardness of Poxylube 42 can be increased by baking at moderate temperatures. Because the lubricating film is dry, it will not pick up dust or become gummy, the company states. Vapor degreasing of parts to be "lubricated" is said to be the only surface preparation that is necessary.

Epoxy laminates

The production of continuously manufactured thin epoxy fibrous glass reinforced laminates with Mylar faces has been announced by Swedlow Inc., Los Angeles, Calif. and Youngstown, Ohio. The material is said to possess excellent physical and electrical characteristics. Widths of up to 48 in., in cut to size sheets or continuous length rolls, are available in thicknesses ranging from 0.006 to 0.060 inch. This epoxy sheeting provides electrical and corrosion resistant properties combined with good physical strength. According to the company, laminates are fungus resistant and flame retardant.

Methacrylate copolymer uses

Introduced a little over a year ago, Dow's styrene methyl methacrylate copolymer, Zerlon, is beginning to find applications in a variety of market areas. In appliances, a washer dial is in use on some of G. E.'s 1960 models. Control knobs made of Zerlon are used on the new Mathes air conditioner, and evaluation programs are under way for complete control panel faces. In the automotive industry radio dial faces made of Zerlon are used on three 1960 models, and the material is being evaluated for taillight and complete cluster panel faces. Other applications include outboard motor speedometer lens, and compass in the marine field; outdoor use as modular decorative screen and sign and display applications; and extruded tracks for sliding kitchen cabinets.

Vinyl coated fencing

Chain-link fencing made of galvanized steel wire with an extruded vinyl covering, which is applied prior to weaving, is now being manufactured by Beautylink Fence & Wire Ltd., Rexdale, Ont., Canada, a newly-formed subsidiary of Standard Wire & Cable Ltd. Called Beautylink, the fencing is available in six colors. So far, most vinyl coated chain-link fencing has been imported from Europe, where it has been widely used in corrosive atmospheres. It is expected that the attractive colors and maintenance-free properties of this product may extend markets beyond industrial fencing.

Molded drawers cut costs

More than 60% of the assembly and fitting time required with wooden drawer built-ins is eliminated with molded styrene drawers, according to Irving R. Stich, president of I. R. Stich Associates, one of the leading home-building firms in the New England area. The drawers, molded from Monsanto Chemical Co.'s Lustrex by the Prolon Div. of Pro-phy-lac-tic Brush Co., Florence, Mass. and Robert A. Schless Co., Elizabethtown, N. Y., are used in built-ins featured in the master bedroom and recreation room of a 7-room split-level home, which is one of four models offered by Stich at Birchdale Heights, Vernon, Conn.

Radiochemicals

New radiochemical compounds are now available from the Radiochemical Dept. of Tracerlab, Waltham, Mass. All compounds are organic in nature, are labeled with Carbon-14 and are available from stock. They (To page 214)

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ing 50% resin. In addition to i

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are: acetone 1, 3-C^{14}—a ketone useful in industrial, organic research; bromoacetic acid 1 and 2-C^{14}; malonic acid 1-C^{14}—useful for the synthesis of amino acids; propylene 1-C^{14}—the monomer of polypropylene and useful in determining its chemical reactions and metabolic fate.

Colorants for plastics

Two new groups of coloring agents for the plastics field have been introduced by Patent Chemicals Inc., Paterson, N. J. One group, designated Perox dyes, is said to be stable to organic peroxide catalysts, heat and light, and soluble in polystyrene, vinyl, and epoxy resins. The dyes are available in a wide range of bright transparent shades or brilliant pastels, when combined with white substrate pigments.

The other group of dyes, called Hytherm, is a line of fast colors in the stable anthraquinone group. They reportedly are soluble in organic solvents, and have noncrystallization properties, and light and alkali fastness.

For blister packages

Cellulose acetate butyrate has been added to the line of acetate sheeting available from Freeport Plastic Sheet Corp., Freeport, N. Y. Aiming primarily at the packaging field, the company is presently extruding clear transparent sheeting in gages suitable for thermoforming blisters. Butyrate's ease of forming while resisting blushing and webbing, and its strength make it useful for blister packaging heavier items. According to Freeport, past objections to butyrate because of its odor have been overcome with a newly developed masking agent.

Rolls 22 in. wide are available in gages of 0.0075, 0.010, and 0.015. Heavier gages up to 0.040 are available in sheet form.

Expanded polyolefins

Non-woven netting made from expanded polyethylene and polypropylene is now available from the Plastics Div. of Reeves Brothers Inc., New York, N. Y. This material begins as a flat strip extrusion ¼ in. thick and 10 in. wide, and is then perforated with slits staggered like courses of brick. When the material is pulled at right angles to the slits, it opens up into a web or netting.

The polyolefin netting is said to combine many of the best qualities of expanded metal and fabric netting, with the resilience of plastics. The price is 15¢/sq. ft. It has a breaking strength of 40 p.s.i. in the axis of elongation and 100 or more p.s.i. in the warp direction. Elongation is 10 to 15% in the warp and about 100% downward in the filling.

The netting is available in a width of 22 to 24 in. in black, white, and a range of colors. Nominal widths of 36, 42, and 48 in. are planned. Both the polyethylene and the polypropylene netting can be stabilized against degradation by ultraviolet rays.

Potential uses include flooring for chicken coops, decorative and filter grids, wastebaskets, boat hammocks, shrubbery protectors, floor mats, furniture seats, fruit conveyor belts, playpens, and shock-absorbing protective shipping wraps.

Compounds for missiles

New compression-molded, high-temperature insulation material up to the 6000° F. range is now available from the Fiberite Corp., Winona, Minn. These formulations carry MIL approval numbers and are now used in missiles.

Fiberite MX-2222-67 is a refrasil fiber reinforced molding compound containing a resin content of 29 percent. It contains 1-in. fibers where the macerated compounds employ ½-in. fibers.

Fiberite MX-1344-67 is a quartz fiber reinforced molding compound with 67% quartz and phenolic. The fine diameter fibers help eliminate resin rich areas encountered in molding compounds containing coarse woven fibers.

Fiberite 4030-190 is a fibrous glass phenolic compound containing 50% resin. In addition to insulating properties it withstands high thermal and mechanical shock, the company states.

Fiberite MX-2549 is a zirconium oxide, carbon and quartz fiber phenolic compound with 78% reinforcement. It withstands high temperatures at low velocities where ablation resistance is an important factor.

Fiberite MX-2625 is a chopped silica fabric phenolic compound. It contains a ceramic frit which fuses and bonds the filler to produce a mechanically sound char as the phenolic resin ablates.

Plan plastics show in USSR

An advisory committee for the U. S. Information Agency's "Plastics—USA" exhibition in the Soviet Union has been selected. The committee membership was recommended by The Society of Plastics Industries' International Committee, headed by Tino Perutz, president of Omni Products Corp. The contemplated plastics exhibit will illustrate American technological achievements in this field, and will show how plastics are manufactured and used in science, industry, the home, sports, and the arts. Time and place for this exhibition have not as yet been determined.

Other members of the advisory committee include Mason Gould, Owens-Corning Fiberglas Corp.; George Lubin, Grumman Aircraft Engineering Corp.; Mrs. Vera Hahn, fashion editor, *Home Furnishings Daily;* Harriet Raymond, Celanese Plastics Co., Div. of Celanese Corp. of America; Armand J. Winfield and Wesley S. Larsen, DeBell & Richardson Inc.; and Hiram McCann, editor, MODERN PLASTICS.

PP for prototypes

A broad line of polypropylene rods and cylinders for the production of prototypes is now available from American Agile Corp., Cleveland, Ohio. These semi-finished moldings can be used for testing of bearing material, pillow blocks, home appliance housings, valves, automotive parts, laboratory and hospital ware. The material can be fabricated with standard woodworking tools and (To page 216)

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equipment, according to the company. Rods are available in 2- and 4-in. with diameters from ½ to 3 inches. Cylinders can be supplied in 4- and 6-in. O.D. by 2-in. I.D. Prices per foot range from \$0.60 to \$27.75, depending on diameter size.

Gold colorants for polyesters

Highly styled decorative panels fabricated from clear polyester resins have been created with the new KC series of permanent gold colorants, available from Claremont Pigment Dispersion Corp., Roslyn Heights, N. Y. The KC series golds, available in three different particle sizes ranging from a fine flake to a coarse flitter, permit the creation of several different new styles in all products now made from polyesters.

Normal cure time of catalyzed resins is said to be unaffected by these colorants. Original color is retained both during cure cycle and also during extended outdoor exposure, the company states.

Resists acetic acid

Tests conducted at the Corrosion Laboratory of Hooker Chemical Corp. are said to have established that Hetron 72 chlorinated polyesters have good resistance to glacial acetic acid at 30 to 35° C. The more conventional polyesters are not considered suitably resistant to this unusually corrosive chemical, Hooker states. The new findings suggest the use of Hetron 72 in laminated products such as storage tanks, piping, scrubbers, columns, ductwork, and similar processing units or equipment.

Foams

Urea-formaldehyde foam. A system for foam-in-place cellular insulation material which has already found broad uses in Europe is now being introduced in the United States through the Kreidl Chemico Physical Co., Hope, N. J. Called Uropor, the system consists of a modified urea-formaldehyde resin used in conjunction with a specially developed spray gun called the Uropor-Sip Foam Gun. This new

material is an open-cell foam with more than 99% voids and can be produced in densities from 0.4 to 1.2 lb./cu. ft. It has a K factor of 0.18 to 0.24. It can support about 10 p.s.i. Uropor is elastic and pliable in thinner pads; white; and essentially odorless after drying out.

The foam is produced by dissolving two powders in water in separate buckets and then inserting suction tubes of membrane pumps in each of the containers. The foam gun is then connected with an air compressor of a rated pressure of about 90 to 120 p.s.i., after which spraying of the foam can commence.

The spray gun produces between 25 and 50 cu. ft. of foam per hour in a continuous operation. In the gun one component is foamed, the foam refined and then mixed with the second component and the mixture leaves the gun in a steady stream as a wet free-flowing foam. The desired mixing ratios of air and of the two components is pre-set by the operator. The foam is moist as it leaves the gun and has a solids content of between 20 and 25 percent. It dries within one to three days, depending on temperature and humidity. Because of its low specific weight, the amount of water which has to evaporate is also very low, the company states.

One of the main advantages of this system is thought to lie in the simplicity of the portable equipment which operates either on electric current or by a hydraulic device operated by the air compressor. Because of the present comparatively slow drying process Uropor is expected to find uses most rapidly in foaming-in-place applications, where the foam can dry in the atmosphere. Another possible application is the spraying of fruit plants where the urea would also act as a fertilizer material.

Uropor is available through Kreidl in resin form or as slab stock. Potential uses are packaging, filters, and pipe insulation.

For one-shot foams. A new silicone-glycol copolymer developed especially for the one-shot urethane process has been introduced by Dow Corning Corp., Midland, Mich. In flexible foams, where this additive is used in concentrations of about 0.5% or less, it produces a high concentration of open cells, whereas in rigid urethane foams, where it is used in concentrations in the range of 0.3%, it gives a high percentage of closed cells. The main advantages of this material are said to be lower cost, because it is effective at lower concentrations; lower foam densities, since it produces a lighter foam; better foam stability, because foams have a firmer, less delicate structure during the critical rise period; and faster processing because the finished foam is said to attain a tack-free surface sooner.

Designated Dow Corning 199, the new silicone is shipped to customers in containers of 8, 40, and 440 pounds.

Fillers for urethane. Aluminum silicates have been used to extend flexible urethane **(To page 220)**

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foam produced by either the prepolymer or the one-shot method, according to Minerals & Chemicals Corp. of America, Menlo Park, N. J. The extenders which reduce foam costs by increasing the foam volume are also said to provide greater resistance to burning and better shock absorption. Preliminary tests show that tensile strengths can be increased without a substantial decrease in elongation. The extenders, designated ASP's, reportedly have the ability to alter the foam's physical characteristics predictably.

Microwave absorber. A flexible polyester-isocyanate foam, designated Eccosorb AN-W, for broadband microwave absorber applications, has been developed by Emerson & Cuming Inc., Canton, Mass. It is said to be weatherproof, fuelproof, and is used mainly in airborne applications such as radar nacelle. It is available in sheet sizes 24 by 24 in. in thickness from ¼ to 2¼ inches.

Price of glycol lowered. A price reduction of 5¢/lb. for its neopentyl glycol (2,2-dimethyl-1,3-propanediol) has been announced by Eastman Chemical Products Inc. At the new price of 32¢/lb. for carload drums Eastman expects to expand the market for the material in polyurethanes, plasticizers, and alkyd resins.

Dimer acid polyester. Flexible urethane foaming formulations for slab stock and molding operations, based on dimer acid polyesters, can now be prepared by the one-shot method. Witco Chemical Co. Inc., New York, N. Y., has developed Fomrez 70 resin which when combined with Dabco catalyst produced by Houdry Process Co., Philadelphia, Pa., and isocyanate, yields a foam that is said to have load-compression characteristics and aging properties suitable for furniture and automobile seating, cushioning, and armrest materials. After expansion, the foam has to be flexed or crushed to prevent shrinkage. Maximum physical properties are obtained by curing the foam in an oven for about 1 hr. at 220° F., or about one week at room temperature, the company states. Depending on the formulation, foams can be produced in densities from 1.9 to 2.7 lb./cu. ft. For the preparation of urethane foams by the prepolymer method, Witco supplies Fomrez D25-30.

Supplies prepolymers. A range of urethane prepolymers for rigid and semi-rigid foams is available from General Latex & Chemical Corp., Cambridge, Mass. Called Vultafoam, they may be used to produce foams in densities from 2 to 25 lb./cu. ft. The low density foam prepolymers are normally based on chemically-blown systems and a typical 2 lb./cu. ft. density has a K factor of 0.11 to 0.14, a foaming time of 2 to 5 min., and a hardening time of 10 to 15 min. at room temperature, according to the company.

Vinyl foam cushions. More than 50 manufacturers offered molded vinyl foam cushions as the only foam cushion, or as a choice of cushions in groupings shown at the January Furniture Markets, according to the Vinyl Foam Div. of Union Carbide Plastics Co. The cushions are tailor-made and engineered for the styling of each manufacturer; and over 40 stock mold sizes are also available. All vinyl foam cushions are double-contoured and fire resistant.

International Furniture Div., of Schnadig Corp., Chicago, Ill., the first manufacturer to introduce this material in upholstered furniture, now features 13 groupings plus 6 Dav-N-Beds, which are reported to be that company's best selling numbers. The Dearborn Co., Oshkosh, Wis., has chosen vinyl foam for one of its quality lines as well as for special promotional offerings. Although the 39 upholstered pieces in the line are offered with either spring or vinyl foam seat cushions, most dealers are reported to have bought only the foam items. According to the company, orders in recent months are running 80% in favor of vinyl foam as against spring cushions. Dearborn also claims no dif- **(To page 222)**

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5 tests
prove that
NEW **Advance**
BC-200 and **BC-206**
are the only
barium-cadmiums
that will pass
all your requirements
with flying colors

PROVE IT YOURSELF

1 Color Control Substitute BC-200 or BC-206 for present liquid Barium-Cadmium or Barium-Cadmium-Zinc stabilizer. Work continuously on 2-roll mill at suitable fluxing temperatures, removing samples at fixed intervals. Compare color maintenance to present stabilizer.

2 Over-all Heat Stability With identical formulations, except for the stabilizer, use oven or continuous mill test. Compare BC-200 or BC-206 with stabilizer currently being used.

3 Clarity Press-mold a thick milled section or laminate milled films to a thickness in excess of 0.100. Compare BC-200 or BC-206 with present Barium-Cadmium or Barium-Cadmium-Zinc system, for crystal clarity.

4 Extended Aging or Storage Stability Prepare milled films containing BC-200 or BC-206, as well as films containing presently used stabilizers. Expose 10 cc. of each stabilizer to uniform air surface area. Allow to age for any desired time interval at room temperature or slightly elevated temperature and/or humidity. Compare aged stabilizers in milled films to the films containing the fresh stabilizers. Oven test all films simultaneously. Note degree of performance loss for each stabilizer.

5 Formulation Versatility Compare BC-200 or BC-206 to present Barium-Cadmium or Barium-Cadmium-Zinc stabilizer, in formulation with and without phosphate plasticizer. Compare stabilizer versatility with lubricants other than stearic acid. Use oven or mill test.

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Simply fill out this coupon and mail to:
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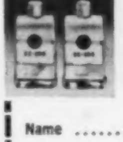
CW Div. of Carlisle Chemical Works, Inc., Reading, Ohio



Advance Solvents & Chemical
Dept. MP, New Brunswick, N. J.

Gentlemen: Yes, I would like to prove it myself. Please send me samples of both BC-200 and BC-206.

Name ....
Title ....
Company ....
Address ....
City .... Zone...... State..............

THE PLASTISCOPE

(From page 220)

ference in public acceptance of vinyl foam compared to foam rubber for furniture.

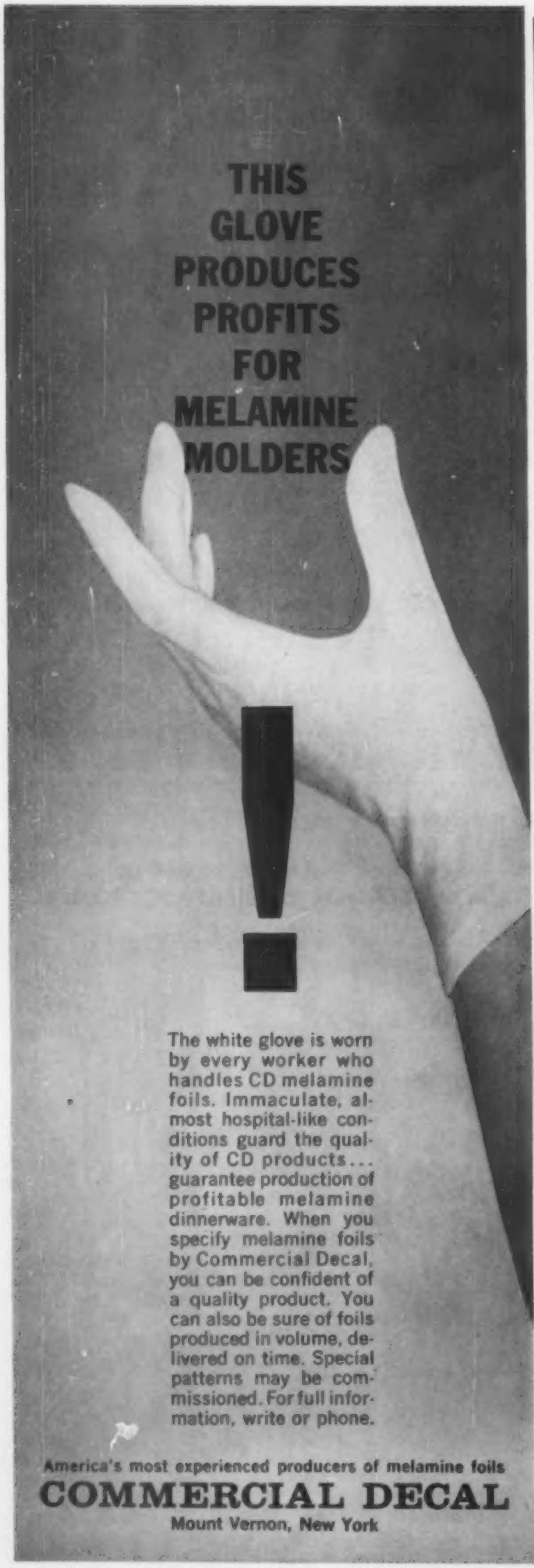
Other uses for molded cushions include casual wrought iron furniture manufactured by Lee L. Woodard Sons, Owosso, Mich.; and a special market grouping of sofa chair, and sectional made by Waynline Inc., Jesup, Ga.

Colored polystyrene beads. Predyed expandable polystyrene beads which, upon being molded produce pastel- and medium-tone colored articles, are now available from Roza Co., Cincinnati, Ohio. Deep tones are available in some colors, the company states. Beads from any of the commercial suppliers may be colored and are supplied on either a custom or a stock basis.

Urethane release agent. Developed for use with one-shot polyurethane foams, a new release agent, Formula-OSR, is a neutral solvent dispersion of waxes and resins. Supplied by Clover Chemicals, Howell, Mich., the thin gel is applied with a rag, brush, or conventional spraying equipment. After the solvent has evaporated, the foam can be poured. After curing, the foam can be stripped either immediately or after cooling of the mold. The release agent contains no silicones and is claimed to have been successfully used on molds made of aluminum, epoxy, and wood.

Self-sealing foam. Flexible urethane foam, with a pressure sensitive adhesive backing has been added to the line of plastic specialties produced by Wallkill Plastics Div. of Union Waxed Paper Corp., Hamburg, N. J. The foam is the polyester type and formulated for cushion packaging purposes. It is available in standard size sheet 54 by 76 in., and 40 by 80 in., and also in cut-to-size sheets in thicknesses from 3/16 to 1 in. in yellow and black.

For packaging. Molded custom suspension packages or corner pads of pulverized polyether foam and a pro- **(To page 225)**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The white glove is worn by every worker who handles CD melamine foils. Immaculate, almost hospital-like conditions guard the quality of CD products . . . guarantee production of profitable melamine dinnerware. When you specify melamine foils by Commercial Decal, you can be confident of a quality product. You can also be sure of foils produced in volume, delivered on time. Special patterns may be commissioned. For full information, write or phone.
America's most experienced producers of melamine foils
COMMERCIAL DECAL
Mount Vernon, New York

THE PLASTISCOPE

(*From page 222*)

prietary binder are available from Leewood Corp., Lowell, Mass. The foam has a density of 13 lb./cu. ft. and can be used to cushion a variety of packages, and is said to be efficient for static loading ranging from 0.5 to 2.0 p.s.i. The foam is said to withstand repeated impact, and is non-abrasive.

New Companies

Vinyl Compositions Ltd., Albert Rd., Lowerhouse, Bollington, Nr. Macclesfield, Cheshire, England, has been formed to manufacture PVC plastisols, organosols, and rigisols, and PVC compounds for extrusion and injection molding. **K. Burgess,** formerly of Imperial Chemical Industries Ltd., heads the new company.

Princeton Chemical Research Inc., Princeton, N. J., has been set up as a new contract research and development company by **Dr. Calvin N. Wolf,** formerly manager of research for Petro-Tex Chemical Corp. Fields of specialization will include petrochemicals, polyolefins, and catalytic processes.

Richoux Italiana S. p. A., Galleria Unione 1, Milan, Italy, was organized by **Frank J. Mikulik,** former manager of Richoux Co. Inc. of New York, and will supply raw materials and decorative inserts to the Italian plastics industry.

A & G Plastics Co., 186 Spencer St., Brooklyn 5, N. Y., was formed for the regrinding and reprocessing of scrap vinyl and styrene, both for resale and on a custom basis. **Albert Bambace** is president of the new company.

Isochem Resins Co., 221 Oak St., Providence, R. I., has been formed to supply epoxy and polyester resin formulations. Several of the officers of the new company were previously associated with **Isochem Resins Corp.,** which has been dissolved.

Key Polymer Corp., 135 Bradford St., Lawrence, Mass., was formed for the development and production of adhesives and coatings from epoxy and urethane polymers. A recently built 2000-sq.-ft. laboratory is now in service, and 100,000 sq. ft. of factory space for manufacture and storage is available. **Jacob Lichman,** formerly development manager for the Coatings and Adhesives Dept. of the Borden Chemical Co., is general manager.

Expansion

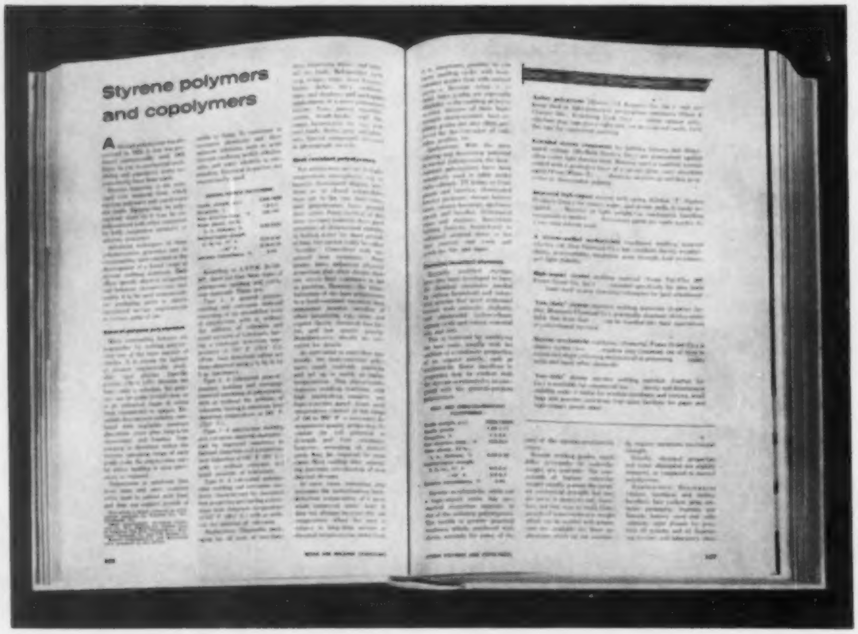
Owens-Illinois Glass Co. is establishing its first Pacific Coast plant, adjacent to its Los Angeles, Calif. glass container facility, for the production of semirigid plastic containers. The plant will be equipped with blow molding machines designed and engineered by O-I and manufactured in the company's machine shop located at Godfrey, Ill.

Aeroplastics Corp., custom molders of expandable polystyrene, is increasing the capacity of its present quarters in Venice, Calif. by the addition of a new 18,000-sq.-ft. building, which is expected to be completed by July 1960.

Delhi-Taylor Oil Corp. is constructing a new plant at Corpus Christi, Texas to produce ortho xylene, which is used in the production of phthalic anhydride, which in turn finds application in the manufacture of polyester plastics and plasticizers for vinyl plastics, alkyd resins for paints, and pigments for paints, plastics, textiles, and floor coverings. The total capacity of the new plant will be approximately 70 million lb./year of high purity ortho xylene. Completion of the facilities is expected in June 1960.

There are now four announced producers of ortho xylene, viz., **Oronite, Cosden, Suntide** in Corpus Christi, and Delhi-Taylor. Ortho xylene is expected to help prevent further shortages of naphthalene which has plagued the plasticizer and paint industry for the past year.

Wyandotte Chemicals Corp., Wyandotte, Mich., is negotiating for the purchase of a site in Washington, N. J. to construct plant facilities for the production of the company's **(To page 228)**



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Hot Tip Nozzles can be used in place of conventional sprue bushings—gate directly into parts or runner system. No external heaters required. Allows small gates and permits prolonged interruption of cycle without freeze-ups.

Makes Better Molded Parts—by producing fast, precise temperature control for conventional and impact molding.

Cuts Costs—by eliminating sprue cutting, grinding and scrap losses. Saves by shortening start-up time, preventing drooling nozzles.

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QUALITY: Highest-Uniform

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ECONOMY: Check these prices.

1 to 11 cans	$1.60 per can
1 to 4 cases (12 cans each)	$16.80 per case
5 to 9 ″	15.60 ″ ″
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20 OZ. GIANT CAN

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The single spindle machine, shown at right, is available with a 15″, 25″, and 75″ diameter molding area; multiple spindle machines with a 25″ and 75″ area. Our complete line of production rotational molding equipment assures the correct capacity machine to satisfy your requirements.

Write or call for detailed data or an appointment.

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FORMS	MOLDS	DIES	MACHINERY
LATEX DIPPING	STEEL AND ALUMINUM	PLASTIC INJECTION	SPECIAL AUTOMATIC

THE PLASTISCOPE

(From page 225)

polyether products including the Pluronic, Tetronic, and Pluracol compounds. These products are widely used in the manufacture of flexible and rigid urethane foams, elastomers, and coatings.

C.S.R.C.-Dow Pty. Ltd., a **Dow Chemical Co.** associated company at Altona, Australia, has added ethylene dichloride, caustic soda, and chlorine production facilities to the styrene monomer units already established there. This expansion represents an additional investment of about $3,375,000 in the Altona plant.

B. F. Goodrich Chemical Co. announced ground breaking for a $4.5 million plant to produce Geon vinyl plastic materials in Australia. The plant, located at Altona, near Melbourne, will be operated by a new company jointly owned by BFG Chemical and **C.S.R. Chemicals Pty. Ltd.**, Sydney, Australia. It will obtain raw materials from the petrochemical operations carried on by other companies in the area. Production is scheduled for 1961.

Claude P. Bamberger Inc., Ridgefield Park, N. J. plastics reprocessors, has rented an additional 8000 sq. ft. of warehouse space in Hackensack, N. J. The company reports that business in 1959 was 35% above the volume of the previous year. **Simon Schochet** joined the company as manager of sales.

Plastics Engineering of Hawaii Inc., 116 S. King St., Honolulu, Hawaii, was organized to supply corrosion-resistant coatings.

Teco Inc., Burbank, Calif. designers of aircraft seating systems, was acquired by **E. Gilbert Mason**, engineer-designer, and **J. Ross Clarke II**, financier. Mr. Mason was named president and general manager, and **Gordon Jones**, former owner and founder, will continue as consultant. An 18,000-sq.-ft. building expansion to accommodate a plastics section is under construction. The new owners will **(To page 231)**

INSERT MOLDING?

Find Out About This

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PRESS!

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175 Ton Oscillating
Table Type Press
6" Stroke
22" Daylight

Designed for profitable insert molding, this is only one of the many French hydraulic presses for the plastics industry. Send your requirements; let our engineers help you meet your requirements most economically.

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Super-strength bonds, to practically any surface — may be machined, filed, drilled, tapped, sawed or sanded — available in different forms for many uses.

CASTING
Forming of parts, holding fixtures, casting forms, electrical connector potting, concrete floor repairs

COATING
Trowellable for sealing cracks in walls, concrete pipe, gelcoating of molds and patterns, gloss coating, sheet metal bonding and sealing

LAMINATING
Glass cloth lamination, impregnation of felt and concrete, reinforcement of glass for sheet metal repair, fabrication of ductwork, chemical storage tank lining

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Aluminum or steel paste for metal repair, sealing of seams, wire rope terminal potting, bonding metal to metal, body work, mounting bolt grouting, filling porous castings

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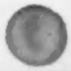

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IN FIELDS UNLIMITED

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NON METALLIC BALLS are used for a great variety of things such as check valves, ball bearings, rollers, detents, etc., as well as many uses in the chemical field. If you have a need, we are equipped to make balls from 1/16" dia. up to 1" dia. in quantity. Samples of many sizes in a range of materials are available.

We can also supply small turnings of cylindrical shapes formed from round rods and tubes for all types of applications. Range of sizes is from 1/8" to 1" diameter and up to 7" long. We hold tolerances of .002 on plastic and .005 on wood, plus or minus.

If a plastic ball will make it better . . .
ORANGE can make it best!

PLASTIC BALL DIVISION

ORANGE PRODUCTS, INC.
554 MITCHELL ST., ORANGE, NEW JERSEY

worried about

THE PLASTISCOPE

cluding film, tubing, and strips. Production and warehousing

(From page 228)

produce the "Mason Seat" contour chair, conceived on a modular principle of systems interchangeability, equally suitable for small private planes or 120 passenger planes.

Monsanto Chemical Co. is constructing facilities at the Plastics Div. plant, Springfield, Mass., for increasing the output of cellulose acetate sheeting by 20 percent.

Dependable Acme Threaded Products Inc., Brooklyn, N. Y., moved into a new building providing 6000 sq. ft. increased production facilities for its Acme Threading Div., which provides custom threading services for plastics and metals.

Witco Chemical Co. Inc. plans to construct a 30-million-lb. phthalic anhydride plant at an East Coast site. The new installation, which will utilize a naphthalene-oxidation process, is scheduled for completion by the last quarter of 1961, and will be Witco's second completely integrated phthalic anhydride producing facility. The other plant, a 20-million-lb. unit at Chicago, Ill., went on stream last year.

American Plastics Corp., New York, N. Y., a subsidiary of **Heyden Newport Chemical Corp.,** has added blow-molding to its line of custom molding services, and will also supply a variety of oval-shaped squeeze bottles and applicator tips from stock molds.

Flightex Fabrics Inc., New York, N. Y. suppliers of industrial fabrics and tapes, has opened a new fibrous glass weaving and finishing plant at Pawcatuck, Conn. Complete laboratory facilities will be available to the reinforced plastics industry at the new plant.

The Borden Chemical Co. is constructing a new Product Development Laboratory and a dry adhesives plant, and is also expanding existing synthetic resin and formaldehyde production at Springfield, Ore. **(To page 232)**

THE PLASTISCOPE

(From page 231)

This facility produces a wide range of thermosetting adhesives, primarily for the local forest products industry, including urea, resorcinol, resorcinol-formaldehyde, urea-formaldehyde, and also phenolic resins.

Thompson Ramo Wooldridge Inc., Canoga Park, Calif., has concluded an agreement to acquire a controlling interest in **Good-All Electric Mfg. Co.,** Ogallala, Neb. A Good-All subsidiary, **Milam Electric Mfg. Co.,** Providence, R. I., manufactures plastic laminated materials for use as insulation in various electrical products.

Formica Corp., a subsidiary of **American Cyanamid Co.,** has added two new "Climate-Labs" to its process engineering facilities in Cincinnati, Ohio.

Yardley Plastics Co., Columbus, Ohio, is constructing a new plant building that will enlarge extrusion production area by 44,000 sq. ft., and increase production capacity by 30 percent. Completion is scheduled for July. The new plant will bring the production area used for plastics pipe and other extruded products to more than 120,000 sq. feet. The company uses an additional 80,000 sq. ft. of space for manufacturing injection molding products.

Cellu-Craft Products Corp. will produce a diversified line of laminated and extrusion-coated films, foils, and papers in a new 40,000-sq.-ft. factory at New Hyde Park, N. Y., costing $800,000. The new building will also house rotogravure printing presses, constant tension-slitter rewinders, and a quality control laboratory.

British Geon Ltd., jointly owned by **The Distillers Co. Ltd.** and **B. F. Goodrich Chemical Co.,** plans a $700,000 extension of its PVC plant at Barry, S. Wales, England.

M & Q Plastic Products, Freehold, N. J., has installed additional equipment for all types of nylon custom extrusion work, including film, tubing, and strips. Production and warehousing areas have also been increased.

Synthane Corp., Oaks, Pa. manufacturer and fabricator of industrial laminated plastics, has increased laboratory space by 30% and added new equipment, including copper-clad tester designed by company engineers, a photo printer and environmental testing equipment for minituarized electronic components and printed circuits.

Tri-Point Plastics Inc. is planning construction of an additional 15,000 sq. ft. for Teflon processing, adjacent to the firm's existing plant in Albertson, N. Y. In addition to tripling the company's existing fluorocarbon extrusion capacity, the new plant will provide facilities for high-precision, molding-forming operations on standard as well as newer types of Teflon.

Tevco Insulated Wire, Burbank, Calif., formerly known as **T. V. Wire Products Inc.,** a manufacturer of extruded plastics covered wire, was acquired by **Nat B. Kaufman,** who becomes president. **Bernard Nelson** is sales manager. The company plans to install additional machinery for plastics insulated wire, wire harnessing, and jacketing.

Allied Chemical Corp., Nitrogen Div., plans to increase methanol capacity at its South Point, Ohio plant by 50% and formaldehyde by 35 percent.

Kent-Moore Organization Inc., Warren, Mich. engineers and manufacturers of special service tools, equipment, and instruments, has purchased **Pyles Industries Inc.,** Detroit, Mich. manufacturer of dispensing systems for coatings, epoxy, foams, and other catalyzed materials. **J. D. Adair,** president of Kent-Moore, also holds this office in the new subsidiary. **Carl B. Penn** is vice-president and general manager of Pyles.

Granny Goose Foods, Oakland, Calif., has acquired **Dantoy Plastics Co.,** Burlingame, Calif. supplier of molded **(To page 237)**

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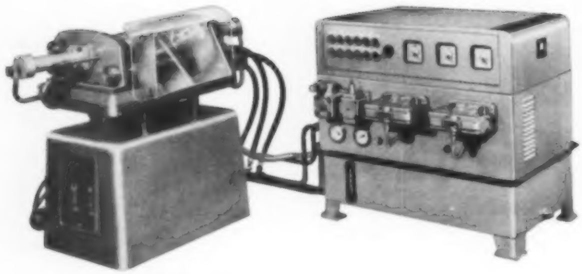
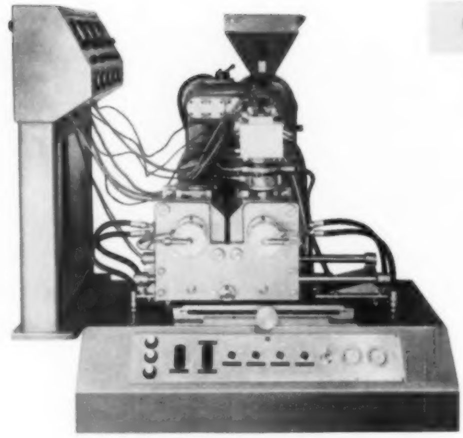


BLOW-O-MATIC (made in Denmark)

		Dry Cycles
	Three sizes ½ gal.	1100
	2 gal.	600
All Hydraulic	5 gal.	225

2



S.C.A.E. (made in Italy)

One Size—One Quart

1200 Dry Cycles—Air Operated

FOR ANY APPLICATION

BLOW M

A Complete Machine or a C

INCLUDING ACCESSORIES:
- Bandera Extruders
- Scrap Grinders
- Refrigeration
- Hopper Loaders
- Drum Tumblers, etc.

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Please send us data on numbers circled.

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1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16

RAINCO DRUM TUMBLERS

ORIGINAL FLOOR LEVEL LOADING

Complet

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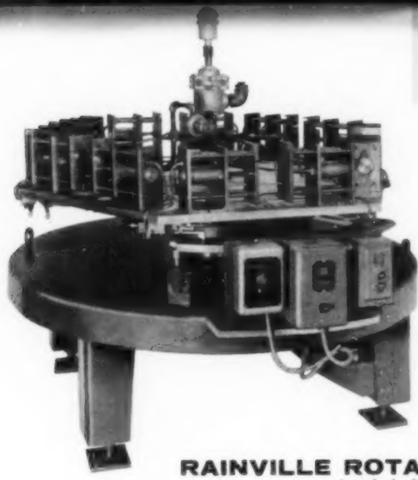
3



RAINVILLE ROTARY
(made in U.S.A.)
6 station—1 quart—1100 dry cycles
4 station—5 gallon—400 dry cycles
6 station—1 quart—2400 dry cycles
(1, 2 or 3 bottles per station)
MECHANICALLY AIR OPERATED

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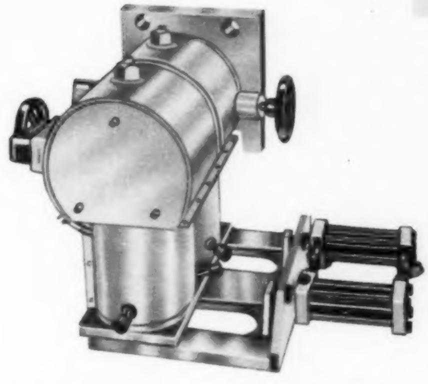

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Single—Double—Triple—Quadruple.

*Heads may be purchased separately for your present machines.

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Complete Plant Installation

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27 ENGINEERS TO SERVE YOU: Garden City, N.Y.; Stamford, Conn.; Quinebaug, Conn. (New Eng.); Newark, N. J.; Philadelphia, Pa.; Franklin, Pa.; Dayton, Ohio.; Detroit, Mich.; Evansville, Ind.; Chicago, Ill.; Milwaukee, Wis.; Minneapolis, Minn.; St. Louis, Mo.; Dallas, Tex.; Los Angeles, Calif.; Toronto, Ont.;

5

RAINKOOL
Refrigerating and Recirculating Units.

	Air Cooled	Water Cooled
6 Models	R-50	R-50W
	R-100	R-100W
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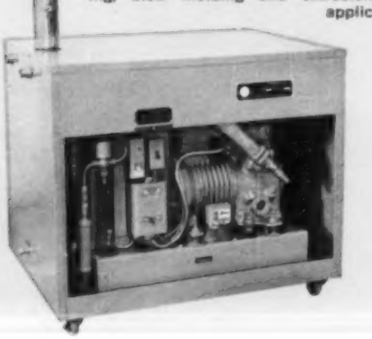
Rainkool Units are trouble free and are guaranteed for one year. These are the first units available RATED IN LBS./HR. OF PLASTIC PROCESSING CAPACITY. Units are running successfully on injection molding, blow molding and extrusion bath applications.



6

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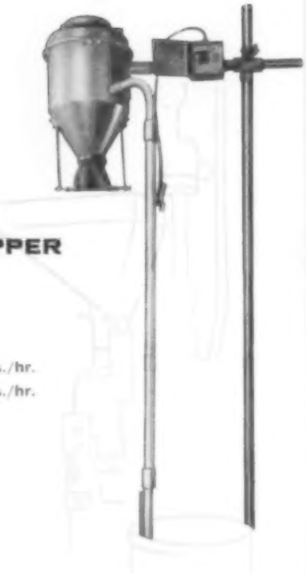
Mold Temperature Control Units

- All brass and copper piping
- Single setting for heating and cooling
- Single—Double—Triple

A Molding Foreman's Dream Unit

pletely Automatic

New Series



RAINCO AUTOMATIC VACUUM HOPPER LOADERS

DUST FREE!!

LR-1000 Series—1200 lbs./hr.
LR-2000 Series—1800 lbs./hr.

Proportional Loading also available.

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RAINCO DRUM TUMBLERS

ORIGINAL FLOOR LEVEL LOADING.

	Max. Drum Size
T-100 Series	23" dia. x 32" high
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Drum Extenders also available

Power saved by balanced drum holder design.

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SCRAP
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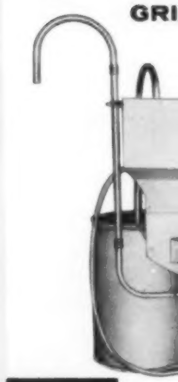
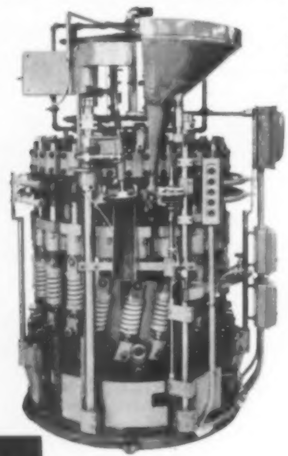


13

ROTARY COMPRESSION MOLDING

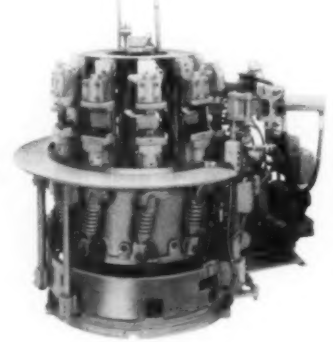


3½ to 10 tons per station—20 station. Fully automatic **continuous** compression molding with powder or preforms.

9

ROTARY TRANSFER MOLDING

Ten station continuous rotary transfer molding for such material as polyester pre-mix, epoxies, alkyds and rubber.
Also operable for insert molding.



10

Manufactured by
Warren Components Division
El-Tronics, Inc.
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15

PALLMANN MILLS

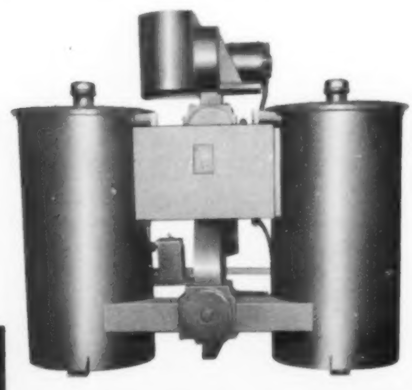
for "Powdered" Thermoplastics down to 100 mesh without refrigerant.

11

UNA-DYN

Dehumidifiers and Hopper Dryers for pre-heating and drying material continuously for extrusion, injection or blow molding.

Model AM-15 Molecular Sieve Dehumidifier.



12

B
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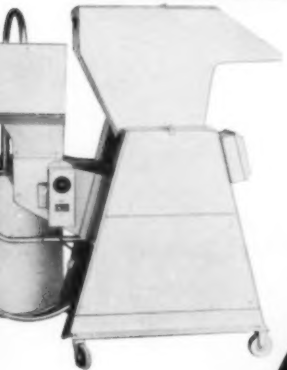
pletely Automatic

RAP HANDLING SYSTEMS

for Molding Scrap / Extrusion Trim Scrap

GRINDER • BLENDER

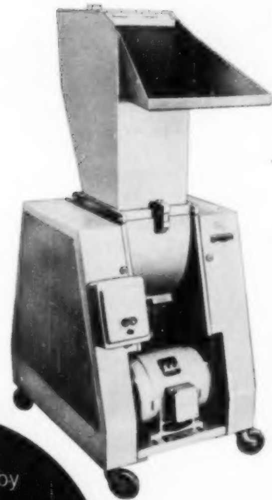
LOADER SYSTEMS



New Series

Beside-The-Press

Grinders



Model	HP	Throat
HD-1	3	8½ x 10
HD-1F	5	8½ x 10
HD-2	5	10 x 14
HD-2F	7½	10 x 14

14

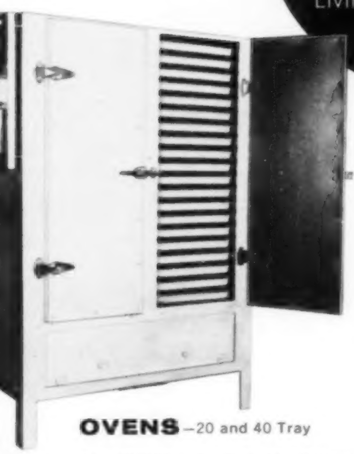
Manufactured by

FOREMOST

MACHINE BUILDERS, INC.

83 Dorsa Avenue

Livingston, New Jersey



OVENS —20 and 40 Tray

For effective drying of all materials

Built tight for use with dehumidifiers

Simple!

Compressed

Air Loaders

- Low Cost
- Efficient

Basic and

Fully Automatic

¾"	150#/hr
1"	300#/hr
1½"	600#/hr
2"	1200#/hr

16

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Permit No. 176
Garden City, N. Y.

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GARDEN CITY, L. I., NEW YORK

(*From page 232*)

industrial products. **William Daniels** will continue as general manager of Dantoy.

S.p.A. Celene, Milan, Italy, jointly owned by **Union Carbide Corp.** and **Societa Edison,** Milan, plans construction of a new production facility for propylene oxide and derivatives adjacent to existing facilities at Priolo, Sicily. The new unit is expected to have an initial capacity of 25 million lb. of propylene oxide annually. The company's initial polyethylene plant is on stream and is now being expanded to a capacity of 65 million lb. annually. Also at Priolo, facilities are now under construction for the production of solvents and plasticizers with a capacity of 70 million pounds.

Columbia Combining Co. Inc., Brooklyn, N. Y., has acquired the controlling interest of **The Jason Corp.** and **Dielectric Engineering & Mfg. Co.,** Hoboken, N. J. Jason is engaged in vinyl finishing, printing, texturizing, and laminating, and was active in the development of the stitchless quilting process. The company recently developed a supported, expanded vinyl foam, which is used in the wearing apparel field. The companies will use the facilities of The Jason Corp., and each company will operate as a separate division. **Benjamin Messing** continues as president of Jason.

Universal Plastics Co., Seattle, Wash. distributor of film, sheets, and rods, is constructing a new warehouse and office building at Maynard Ave. and Adams St. which will more than double the company's present facilities at 1105 Westlake Ave. N. The new facility will cost $80,000, and contains 10,000 sq. ft. of floor space.

The Carwin Co., North Haven, Conn., is building a new Houston, Texas plant that will more than double the existing capacity for the company's specialty isocyanates, including PAPI, which is used to provide superior adhesion between rubber and vinyl fabric and in pro- **(To page 241)**

Experience builds confidence

This is a story about FOAMS... urethane foams

POLYETHER-BASED URETHANE FOAMS, chalking up new successes and spawning new applications at a remarkable rate, are fast becoming one of industry's most exciting developments. Their low cost, ease of application, and variety of forms (ranging from supple flexibility through semi-rigid to most rigid types) have tickled the imagination of thousands. Here are some developments to date:

the widest range of desirable properties of any available industrial foam

more accurate control of degrees of toughness, resilience, weight per unit volume, shock absorbency, insulating properties

marked price advantages over polyester foams and foam rubber

a solvent-blown rigid urethane foam which can be applied with readily available standard portable hot-spray catalyst equipment

But, as with all new developments, experience is an all-important factor. It can prevent costly mistakes, fruitless evaluation, conserve priceless laboratory time, cut costs, and insure greater product satisfaction.

So, if you have an interest in urethane foams – either flexible, semi-rigid, or rigid types – consider these facts:

1. Wyandotte pioneered in the development of the polyethers that have greatly improved urethane foams, given them a longer useful life, lowered their cost, and offered a far wider range of desirable properties.

2. Wyandotte was the first to develop a sprayable solvent-blown polyether rigid foam.

3. Wyandotte has extensive urethane application and development laboratories cooperating with all manufacturers of urethane foams, and with prepolymer manufacturers on the latest urethane-foam formulations.

This valuable experience (and our facilities) are available to you if you make, wish to make, or use urethane foams as a part of your own products or processes. Just write us, describing your requirements in as much detail as possible. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

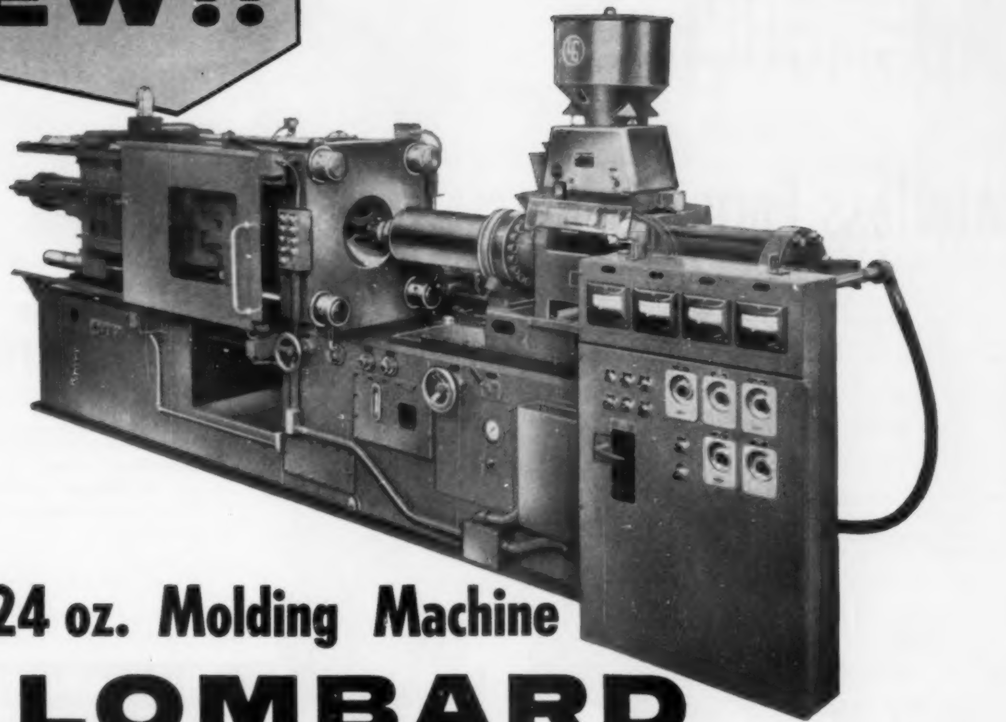
Wyandotte's urethane-foam raw materials include: PLURACOL® Series of Triols, used for one-shot flexible foams and for the preparation of rigid urethane foams; PLURACOL Diols, used for prepolymer-type flexible foams and to impart strength properties to one-shot flexible foams; TETRONIC® Polyols, for improved resilience and moldability; QUADROL®, a very reactive cross-linking agent and catalyst; DHP-MP, a catalyst with extremely low odor.

Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION

PACING PROGRESS WITH CREATIVE CHEMISTRY®

NEW!!



18/24 oz. Molding Machine

by LOMBARD

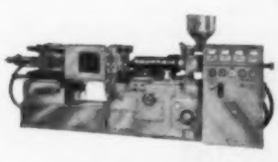
FASTER THAN MOST 12/16 oz. MACHINES

HAS ALL THESE "*MODERN-AS-TOMORROW*" FEATURES

- **Big, rugged, fast**
- **50" daylight opening**
- **Plunger speeds over 400 in./min.**
- **24" clamping stroke — 450 ton clamping pressure**
- **Injection rate over 1400 cu. in. per min.**

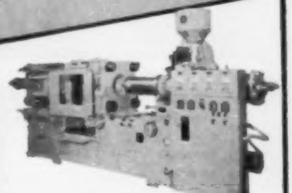
REMEMBER! There's a **LOMBARD** for all your molding requirements that incorporates refinements beyond the expectations of today's or even tomorrow's demand.

SEND FOR COMPLETE CATALOG

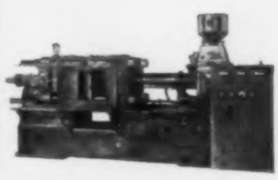


No. 2414-6
- 6/9 oz.
- 32" daylight opening
- Max. die size 14⅞" x 28"

No. 3214-12
- 12/16 oz. economy model
- 36" daylight opening
- Max. die size 20" x 36"



No. 3220-125
- 12/16 oz. high speed model
- 42" daylight opening
- Max. die size 20" x 36"



No. 3220-16
- 16/20 oz. model
- 42" daylight opening
- Max. die size 20" x 36"

Injection Molding Machine Division

LOMBARD GOVERNOR CORPORATION

Ashland, Massachusetts

THE PLASTISCOPE

(From page 237)

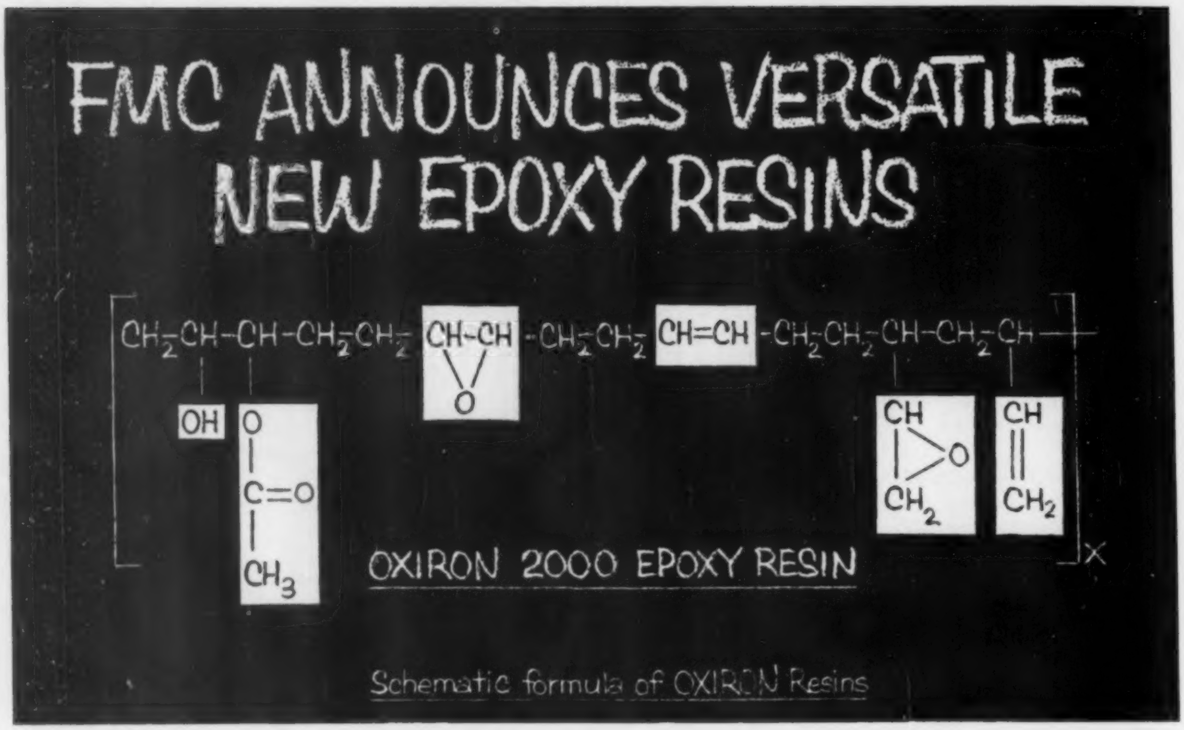
duction of higher heat-resistant urethane foams. **R. G. Schmidt,** formerly manager of Callery Chemical Co.'s plant in Lawrence, Kan., joined Carwin to become manager of the new facility.

Farris Engineering Corp., Palisades Park, N. J., has formed a new division, to be known as **Farris Universal Machine Corp.,** which will market a line of machines for the plastics industry. The company's first item is a "take-off" unit for extrusion operations. **George F. Plain,** formerly of Celluplastic Corp., was named product manager for the new division.

Frank W. Egan & Co., Somerville, N. J. manufacturer of plastics and paper processing equipment, is adding 38,000 sq. ft. of working space to its 30,000-sq.-ft. building. Completion is scheduled for September of this year. The company's assembly dept. will be doubled to 9,000 sq. ft., which will permit the integration of assembly facilities now located in another part of town.

Columbia - Southern Chemical Corp. has begun construction of an ethylene dichloride plant adjoining the company's chlorine and caustic soda manufacturing operation at Lake Charles, La. The new facility, which will cost in excess of $1 million, marks the company's entry into chemicals based on ethylene and is the first captive use of chlorine produced at the Lake Charles location. Initial production is scheduled for September. Columbia-Southern has a contract with **Petroleum Chemicals Inc.** for the supply of ethylene. Ethylene dichloride is a basic material used in the production of vinyl chloride.

Perforating Industries Inc., formerly of Roselle Park, N. J., has completed construction of its new 10,600-sq.-ft. plant at 602-610 Commerce Rd., Linden, N. J. Additional machinery, storage area, and manpower is claimed to enable the company to handle custom perforating, **(To page 244)**



OXIRON Epoxy Resins Offer Multiple Reaction Sites Plus Unique Vinyl Reactivity

OXIRON 2000 Series Resins are Highly Reactive.

The unusual molecule of FMC OXIRON Resins affords *10 or more* reaction sites. They can be cured through reactive double bonds as well as epoxy and hydroxyl groups. Multiple epoxy groups are located at external positions and internally along the hydrocarbon backbone.

Unlike conventional epichlorohydrin epoxies, OXIRON Resins are epoxidized polyolefins. Because of their unusual combination of properties, they offer many new application possibilities.

OXIRON Resins Offer the Following Advantages:

Novel Cure: Can be peroxide cured through reactive double bonds as well as with conventional epoxy curing agents—high reactivity with anhydrides and dibasic acids at low temperature— increased pot life with polyamine cures—reactive with a wide variety of other curing agents, e.g., polyphenols, Lewis-type catalysts, polysulfides.

Economy: Low-cost curing agents may be used in high proportions.

Low Density: 20% lighter than ordinary epoxies—cured resins likewise have lower density.

Outstanding Chemical and Electrical Resistance: Excellent resistance to alkalis, acids, and solvents —cured resins have good electrical properties.

Superior High Temperature Performance: Combination peroxide and anhydride cures give high heat distortion point resins. The unique flatness of the heat distortion curves of OXIRON Resins translates to acceptability for practical use at temperatures ranging far above the heat distortion point itself. OXIRON Resins show superior high temperature aging.

Send for our *FMC Epoxy Data Booklet* which describes OXIRON 2000, 2001 and 2002 in detail, contains curing information and gives suggested uses. After deciding which resin will best suit your needs, we will supply laboratory samples upon request.

FOOD MACHINERY AND CHEMICAL CORPORATION
Epoxy Department (MP-5)
161 East 42nd Street, New York 17, N. Y.

THE PLASTISCOPE

(*From page 241*)

slitting, and blanking on foams and other flexible materials, as well as rigid sheets at the rate of 2½ to 4 million yd./year.

Mastex Industries Ltd., a subsidiary of **Canadian Industries Ltd.**, is constructing a new film and converting plant at Brampton, Ont., Canada. The plant, scheduled for operation in September of this year, will employ approximately 150 people initially, and will produce polyethylene film and convert it into products such as bags, sheets, and rolls, both printed and plain. A converting plant and PE film extrusion plant will be moved from Rexdale, Ont. to the new location. CIL, through its subsidiary, now becomes the first fully-integrated producer of polyethylene film products in Canada.

Deceased

Robert M. McGee, 57, technical service representative for Plaskon Molding Compounds at the Toledo, Ohio plant of the **Plastics & Coal Chemicals Div., Allied Chemical Corp.**, died March 9 after an extended illness.

Meetings

Plastics groups

June 1, 2: The Society of the Plastics Industry Inc., Cellular Plastics Div. Automotive Conference, Statler Hotel, Detroit, Mich.

June 15-20: 7th International Salon of Plastics Materials, Hotel de Ville, Oyonnax, Ain, France.

Other groups

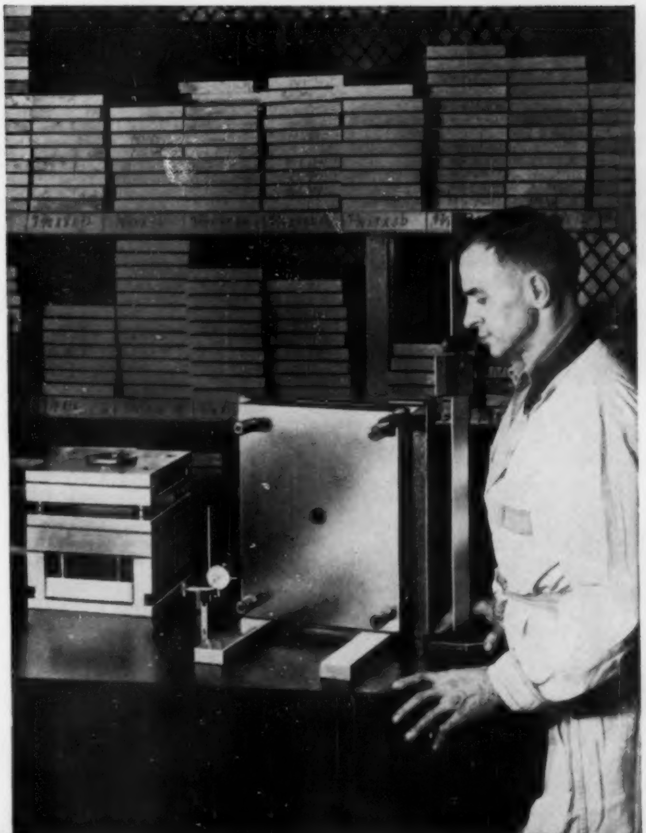
May 18: Chemical Market Research Association, "Chemicals and Plastics in Construction," Biltmore Hotel, New York, N. Y.

May 19, 20: Engineering Institutes, University Extension Div., The University of Wisconsin, Madison, Wis., "Plastics Applications—Fibers, Fabrics, and Films."

July 11-15: National Housewares Manufacturers' Association, 33rd National Housewares Exhibit, Convention Hall, Atlantic City, N. J.—**End**

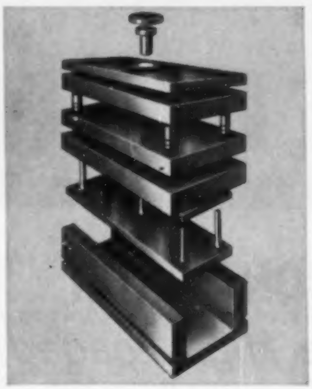
3 WAY SAVINGS

WITH D-M-E STANDARD MOLD BASES



1 ADDED QUALITY

Exclusive design features provide extra-cost construction at standard prices! You get first-quality carbon or alloy steel, all surfaces ground flat and square, plus these features offered only by D-M-E: Patented tubular dowel construction; one-piece ejector housing; stop pins welded to ejector bar; sizes to 23¾" x 35½"; and the assurance that every D-M-E product is inspected *by the most modern methods and equipment.*



2 ◀ GREATER ECONOMY

Interchangeability lets you replace *any* component without special fitting or re-working! What's more, you can select from the widest range of Standard Mold Bases available anywhere—over 7,000 cataloged combinations.

3 FASTER SERVICE ▶

Delivery from local stock means you get Standard Mold Bases, components and moldmakers' supplies when you need them—direct from D-M-E's fully-stocked local branches!

ARE YOU GETTING THE NEWS?

D-M-E's monthly publication is full of cost-saving ideas for designers, moldmakers and molders. Write on your letterhead—we'll place your name on the "NEWS" mailing list. No cost, no obligation.

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Contact your nearest branch for fast deliveries!

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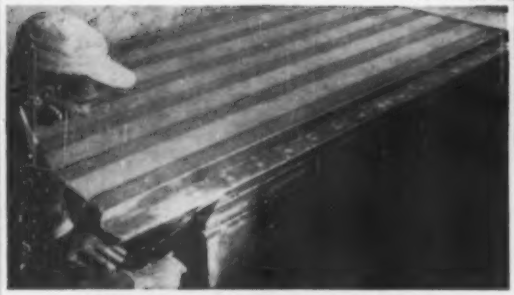
60-B

One-call service on Standard Components for Plastic Molding and Die-Casting

Injection and Compression Mold Bases • Injection Unit Molds • Cavity Retainer Sets • Mold Plates • Ejector and Core Pins • Ejector Housings • Leader Pins and Bushings • Sprue Bushings • Moldmakers' Tools and Supplies



Removing reinforced plastic panel from matrix on which it was densified.

Installing epoxy-glass panel in steel frame during assembly of structure.

GIANT REINFORCED EPOXY CONTAINER

Holds up to 40,000 lbs., Stacks Five High Loaded!

This twenty-four foot by eight foot shipping container is the latest development in reinforced plastics. Constructed of 4′ x 8′ epoxy-fiber glass panels fastened to a steel frame, it combines outstanding strength with light weight. It offers wide possibilities for bulk shipment by rail, truck or ship . . . and can be stacked five high, fully loaded.

The container was developed at Union Carbide Development Laboratories using BAKELITE Brand Epoxy resins. Panels were fabricated with a new spray gun that blends the epoxy resins and hardener automatically. Each panel has an epoxy-glass core built up on corrugated cardboard and sandwiched between two epoxy-glass sheets each one-tenth of an inch thick.

Severe tests showed a floor deflection of only three-tenths of an inch, after being loaded with 40,000 pounds of water. Use tests are now underway.

For information on the construction and testing, write Dept. AT-87, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada:* Union Carbide Canada, Ltd., Toronto 7.

UNION CARBIDE

FIRE retardant for PLASTISOLS: CHLOROWAX® LV by DIAMOND

Suggested Formulation for Flame Retardant Plastisol

	Parts
Diamond Alkali PVC-70	100
DIOP	18
Santicizer 141 (1)	45
Chlorowax LV	10
Antimony Trioxide	10
Tinuvin P (2)	0.05
Mark KCB (3)	2.5
Paraplex G-62 (4)	5

(1) Monsanto Chemical Company
(2) Geigy Chemical Corporation
(3) Argus Chemical Corporation
(4) Rohm and Haas Company

Viscosity	Brookfield Model RVT-200 #6 Spindle 100 RPM
Initial	29.8 poises @ 77° F
48 Hours	44.0 poises @ 77° F
Brittle Point	−47° C
Fadeometer	No discoloration after 300 hours
Diamond Alkali Loop Test	No Spew

By using CHLOROWAX LV as a secondary plasticizer in your formula, you can add greatly to its value and often widely extend its applications at a lower cost. This Chlorowax LV formula can provide a high degree of flame retardation for calendered or impregnated fabrics used in draperies, coverings, tents and for other purposes. Find out more. Write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

COMPANIES...PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Ludlow Papers, Div. of Ludlow Mfg. & Sales Co., Needham Heights, Mass.: **Dr. Austin W. Fisher Jr.** promoted from research dir. to v-p technology. He will be in charge of the over-all tech. program including research, quality control, tech. service, and engineering development for all plastics and paper products. He is succeeded by **Dr. Howard H. Reynolds**, previously mgr.—tech.

Fisher Reynolds Yahres

dept., Cryovac Div. of W. R. Grace & Co. **Robert M. Yahres**, formerly with American Viscose Co., joined as dir. of quality control. **Walter F. Biggins**, previously mgr. of quality control, named to the newly created post of mgr.—tech. service.

Allied Chemical Corp.: Dr. Frank L. Holloway assigned responsibility for liaison with government tech. agencies in matters relating to new products, representing all Allied's divisions. **George A. Benington** retires from his post as v-p—advertising and trade relations.

Plastics & Coal Chemicals Div.: Leon W. Miller, asst. and consultant to the exec. v-p, and former dir.—chemical sales, retired.

National Aniline Div.: Morris E. Packman Jr. appointed tech. asst. responsible for the coordination of R & D activities in the chemical areas. **Richard J. Herdlein** joined the tech. service dept. in the isocyanates section at Buffalo, N. Y.

Rexall Drug & Chemical Co.—Chemical Div.: Dr. Michael Erchak Jr., formerly tech. dir. of Semet-Solvay Petrochemical Div., Allied Chemical Corp., named v-p for R & D. **Blaine B. Kuist**, previously with the Fluor Corp., will serve as v-p of engineering and construction.

Chippewa Plastics Co. established a sales office at 5111 Sheridan Rd. N., Chicago, Ill. **George N. Keyser**, field sales mgr., will head the new office. The company produces PE film.

Pittsburgh Coke & Chemical Co. consolidated its three chemical divisions in a new wholly-owned subsidiary company named **Pittsburgh Chemical Co.** The new company will bring together the parent company's Activated Carbon, Protective Coatings, and Industrial Chemicals Divs., and supporting chemical group staff depts. Sales of Pittsburgh Chemical Co. are expected to account for nearly one-third of Pittsburgh Coke's sales in 1960, and the new subsidiary plans to spend approximately $7 million for plant expansions this year. The organization of Pittsburgh Chemical Co. will be patterned after the parent company's former chemical group, and will utilize the same personnel and plant facilities.

Officers of the newly formed Pittsburgh Chemical Co. are: **W. Kenneth Menke**, pres.; **Henry Avery**, exec. v-p; **Jonathan C. Cooper**, v-p and gen. mgr. of the Activated Carbon Div.; **Arthur E. Gray**, v-p and gen. mgr. of the Protective Coatings Div.; and **Duncan J. MacLennan**, v-p and gen. mgr., Industrial Chemicals Div.

Johns-Manville Sales Corp., Glass Textile Section: Stewart W. Schulmeyer named staff mgr. of plastic reinforcement sales, replacing **George L. Smead**, who resigned to enter the boat mfg. business. **James J. Secor Jr.**, formerly regional staff mgr. at Chicago, Ill., succeeds Mr. Schulmeyer as staff mgr. for electrical and industrial yarn sales, headquartering at Toledo, Ohio.

Shell Development Co., Emeryville, Calif.: **Reed Bell** promoted from research chemist to research supv., heading a group engaged in research on polymer synthesis. **Dr. George A. Gillies** joined the company's research center as a chemist in the plastics and resins dept.

Tri-Point Plastics Inc., Albertson, N. Y.: **Don Singer**, former asst. gen. mgr. of Emerson Plastics Corp., appointed special asst. to the dir. of sales. **Roland Gray** named head of a new group which will accelerate the company's development of new Teflon products, as well as render technical assistance to customers in the electronics, missile, instrument, and related fields.

Rogers, Corp., Rogers, Conn.: **Norman L. Greenman** elected v-p, marketing. **Walter A. Hayes Jr.** and **Robert G. Lanzit**, previously sales engineers with the company, named regional sales mgrs. for the Middle Atlantic states, and the Midwestern and Southern states, respectively.

Blackman Plastics Inc. consolidated all mfg. operations by moving its Industrial Products Div. from Los Angeles, Calif. to newly constructed facilities at 1120 W. Industrial St., Escondido, Calif. The Blackman Toy & Hobby Div. was moved to the new quarters early last year. Sales engineering, experimental, and short-run production facilities for models and prototypes of the Industrial Products Div. will be maintained permanently at 3129 S. La Cienega Blvd., Los Angeles.

Reichhold Chemicals Inc. appointed new v-p's for the following areas: **Joseph E. D'Angelo**, mfg., Elizabeth, N. J. plant; **William O. Fetterly**, mfg., and **Thomas P. Shumaker**, sales, Tuscaloosa, Ala. Div; **Edward F. Kelly**, mfg., Chemical Color Div., Brooklyn, N. Y.; and **Rudolph H. Melinat**, Pacific Southern Div., Azusa, Calif.

Monsanto Chemical Co.: Charles H. Sommer, previously exec. v-p, elected pres. He succeeds **Charles A. Thomas**, who becomes chrmn., replacing **Edgar M. Queeny**. **Edward F. Lynch Jr.** appointed to the newly-created position of mgr.—distributor relations. He will work with the Plastics Div. and the other operating divisions to develop a national distributor network.

B. F. Goodrich Chemical Co.: Harry B. Warner, previously v-p—marketing and a former v-p development, was named pres. He succeeds **John R. Hoover**, pres. since 1951, who elected early retirement after 35 years with the company. **Thomas B. Nantz**, formerly v-p—manufacturing,

Warner Hoover Nantz

succeeds Mr. Warner, and **Robert D. Scott**, moves from v-p development to v-p mfg. and development.

Gerald A. Balzersen, previously operations mgr. at the Avon Lake, Ohio development center, appointed plant mgr. of the vinyl resin plant, Niagara Falls, N. Y. He succeeds **P. H. Lawrence**, who becomes plant mgr. for the vinyl resin and compound plant now under construction near Long Beach, Calif. **A. R. Webber** named mgr.—production and tech. operations at Long Beach. **Arne Melby** appointed project mgr. for the construction of a BFG Chemical Co. vinyl plant in Australia. **Marshall L. Madlen** transferred to the International (To page 251)

(From page 248)

Dept. to supervise design and construction of additional vinyl production facilities for **Geon de Mexico, S. A.**—an associate company—at Mexico City, Mexico.

Howard M. Sprock Jr. appointed market development rep. servicing textile firms in the southeastern states. **Harry J. Glutting Jr.** named plastic materials sales rep. with headquarters at San Francisco, Calif.

The Du Pont Co.'s plastics laboratory at Chestnut Run, near Wilmington, Del., has been renamed the Technical Services Laboratory.

Celanese Plastics Co.: K. W. Kithil named field sales mgr.; **R. M. Leiter** appointed sales mgr. for molding compounds and resins; and **R. J. Werner**, formerly asst. gen. sales mgr. of **Celanese Chemical Co.**, has been appointed sales mgr. for both film and packaging.

Durez Plastics Div., Hooker Chemical Corp.: Robert M. Stroman appointed mgr., Buffalo, N. Y. sales dist., and **Edward F. Borro Jr.** named asst. product mgr., molding compounds, in the sales dept.

Pennsalt Chemicals Corp., Philadelphia, Pa., formed a research products development dept. as part of its Technical Div. The new dept., headed by **Dr. John F. Gall**, will concern itself with the commercial potentials of such new developments as Pennsalt's polyvinylidene fluoride resin, RC-2525; high energy perchloryl fluoride; and the trifluoroethyl intermediates and aerosols which have recently come out of the company's research laboratories. **Lester E. Robb**, formerly on the R & D staff, and **G. H. Edward Walden**, formerly assigned to the commercial development dept., transferred to the new dept.

Commercial Chemical Development Assn.: Dr. James G. Affleck, American Cyanamid Co., chosen pres.-elect; **Winthrop M. Barnes, Sun Oil Co.**, elected exec. secy.; **Dr. Alfred G. Rossow, Mobil Oil Co.**, named treas.; **Dr. Robert I. Stirton, Oronite Chemical Co.**, and **Harry F. Pfann, Pittsburgh Coke & Chemical Co.**, elected directors.

The Ceilcote Co., Cleveland, Ohio, consolidated the company's operations in the Middle Atlantic states into a newly established office and warehouse at 191 Fourth St., Trenton, N. J., under the administrative supervision of **John C. Galloway**, Eastern sales mgr. All product warehousing and installation equipment as well as the sales offices will be housed in the new headquarters. Ceilcote produces **(To page 253)**

Naugatuck KRALASTIC

(From page 251)

corrosion-proofing linings, coatings, cements, etc., and RP ventilating systems and processing equipment.

Taylor Fibre Co.: Edward J. Guelpa appointed gen. mgr. of the Western Div. at La Verne, Calif., replacing **Milton F. Chapel,** who resigned. **Peter J. Longarzo, Thomas E. Coyle,** and **Robert C. Clark** have recently been appointed sales engineers.

National Vulcanized Fibre Co.: Roy S. Fisher appointed administrative v-p. In addition to his previous responsibilities as sales v-p, he will be responsible for the industrial relations order-service, traffic and marketing depts. **Raymond H. Fowler** and **Florian J. Zukas** joined the R & D laboratory as resin chemists.

National Distillers & Chemical Corp. —U. S. Industrial Chemicals Co.: Donald O. McCarthy named asst. production mgr. for Petrothene polyethylene resins. **Clifford E. Oman** named asst. to the dir. of production. **James R. Smith,** plant mgr., now assumes full responsibility for Tuscola, Ill. plant operations.

The Kordite Co.: Dr. Harry A. Kahn and **Dr. Robert H. Steiner** promoted from projects mgrs. to associated directors, R & D. **Werner T. Meyer** named gen. mgr. of foreign operations for the company.

Commercial Plastics & Supply Corp., New York, N.Y., established an Export Sales Div. headed by **Arthur E. Herman,** pres. of the company. **Richard L. Arnold** joined the sales force of **Commercial Plastics of Florida in Miami.**

Sanitized Sales Co. of America Inc. moved from 181 Madison Ave. to new and larger quarters at 53 E. 34th St., New York 16, N. Y. The company distributes bacteriostatic chemicals used in the manufacture of plastics.

Falls Engineering & Machine Co., Cuyahoga Falls, Ohio: **David Wright** named v-p and sales mgr.; **Ashton L. Worrall Jr.** appointed chief engineer; **Archie E. Bragg,** production mgr.; **Carl L. Ford,** development engineer; **Paul A. Frampton,** sales and service engineer; and **Robert Hague,** mgr. of service operations. The company makes foam slitters and other converting machinery.

Fiberfil Inc., Warsaw, Ind.: **John Fletcher** named dist. mgr. of the New York, New England area, succeeding **Thomas P. Murphy,** who was recently promoted to development mgr. **George Sherman** is a new sales rep. specializing in automotive accounts throughout the Detroit, Mich. area. **Stanley W. MacDonald** joined the sales staff at the firm's Chicago, Ill. dist. office. The company manufactures RP molding compounds.

International Paper Co., New York, N. Y., formed a Paper-Plastics Sales Div. to coordinate sales activities. **J. L. DeRose** was named div. sales mgr. He will be assisted by **C. J. Sewell, R. W. Emery, D. M. Sullivan, E. C. Leavy,** and **E. R. Pardo.**

O'Sullivan Rubber Corp., Winchester, Va.: **C. Robert Creamer Jr.** named v-p and gen. mgr. of the Plastics Div. **Dr. R. C. Evans,** previously engaged in plastics research, promoted to dir. of research.

Westgate Design Service Inc., mold designers for the plastics and rubber industries, moved to 1149 Kenmore Blvd., Akron, Ohio.

The Dow Chemical Co.: Arnold A. Butterworth promoted from asst. to the sales mgr. to sales mgr.—plastics dept. The company's plastic products account for approximately 35% of total annual sales. He succeeds **G. J. Williams,** who has been promoted to asst. gen. sales mgr. In Plastics Tech. Service, **Robert E. Monica** advanced from head of the extrusion section to mgr.—molding materials group. He is succeeded by **C. Robert Webster,** formerly in charge of plastics quality control. **William J. Sauber,** previously customer service engineer in charge of the chemical testing laboratory, is now in charge of quality control. **Robert F. McFedries** now heads the chemical testing laboratory.

Butterworth

John Keselik promoted from prod. supt. to mgr. of the Riverside plant, Pevely, Mo., which produces Styrofoam polystyrene foam. He succeeds **Robert E. Reinker,** who was appointed asst. to the operations v-p of **Dow Chemical International Ltd., S. A.** He will direct production of Styron polystyrene at plants to be built in Italy and Greece.

The Dobeckmun Co.: Thomas F. Dolan, founder and pres., retired but will continue as chrmn. of the exec. committee. He is succeeded by **John G. Staudt,** formerly exec. v-p of the Dowell Div. of Dow. **W. C. (Bill) Dougan** named New York regional sales mgr.

Bendix Aviation Corp., Kansas City Div.: Ralph Neighbors, formerly with Spencer Chemical Co., and **Don McCoy,** previously with Thompson-Hayward Chemical Co., joined the polymer chemistry and engineering group.

Cadillac Plastic & Chemical Co. opened a new warehouse and sales office at 949 E. 11th St., Oakland, Calif., to serve the **(To page 257)**


Naugatuck KRALASTIC
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family of
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• HIGH GLOSS
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(From page 253)

east shore San Francisco Bay region. **Frank M. Hunt,** mgr. of the company's South San Francisco branch, will also be in charge of the new unit.

Visking Co., Div. of Union Carbide Corp.: Howard R. Medici, pres. since 1955, appointed chrmn. **Glenn L. Pitzer,** formerly a v-p of **Union Carbide Plastics Co.,** named pres.

Plastic Molders Supply Inc., Fanwood, N. J., appointed **Frank Arena** special rep. in the Chicago, Ill. area. **Glenn Skov** named dist. sales rep. in Michigan. **Robert Kates,** appointed dist. sales rep. for Eastern Ohio, will work out of the PMS Norwalk, Ohio plant.

Thermoplastic Equipment Corp., 1261 Valley Rd., Stirling, N. J., is a new div. of **Thermoplastic Processes Inc.** The company manufactures the Vertical 1250-B extruder for the manufacture of two-colored items: striping, coding, coating, etc.

Robert L. Davidson elected president of **Kurz-Kasch Inc.,** Dayton, Ohio custom molder of thermosetting plastics. Mr. Davidson has been with the company since 1946, and held the position of vice president and sales manager prior to his new appointment. The retiring president, **W. G. Davidson,** will continue as treasurer.

Davidson

Nicholas Glad appointed sales rep. in the metropolitan New York area for **Olsenmark Corp.,** 124-132 White St., New York, N. Y. mfr. of roll leaf and hot stamping presses, and specialized marking equipment.

Allan B. Black named tech. sales rep. in New York City and Long Island for **Rona Pearl Corp.,** a div. of **Rona Laboratories Inc.,** Bayonne, N. J. mfr. of synthetic pearl and natural pearl pigments.

L. L. Scott appointed sales engineer of **Western Backing Corp.,** Culver City, Calif. processor of resins, reinforced fibrous glass, and other synthetic and natural fibers for aircraft, missiles, and general industry.

Neil D. MacKay joined the injection molding dept. of **The Stanley Chemical Co.,** East Berlin, Conn., a subsidiary of **The Stanley Works,** as a plastics engineer.

Roger G. Richards appointed to the newly-created position of mgr.—planning and (To page 259)

COMPANIES...PEOPLE

(From page 257)

development of **Diamond Alkali Co.'s** plastic div. He is succeeded as sales mgr. by **Harry E. Connors Jr.**, former product mgr.—paste resins.

Richard Strauss appointed development mgr. of **National Polychemicals Inc.**, Wilmington, Mass., producer of organic chemicals, plasticizers, and synthetic resins.

Marvin Levine appointed dir. of R & D, Plastics Div., **General American Transportation Corp.**, Chicago, Ill., custom molders. He will headquarter at the company's laboratories in East Chicago, Ind.

Dr. George R. Mitchell promoted from asst. mgr. to mgr., R & D, for **The Glastic Corp.**, Cleveland, Ohio mfr. of fibrous glass reinforced plastic electrical insulation.

Daniel P. We'el appointed mgr. of plastics sales for the paint div. of **Pittsburgh Plate Glass Co.** He succeeds **Dr. E. H. Haux**, who retired after nearly 30 years of service with the company.

James M. Dill appointed to the newly-created position of special products sales mgr. for **Russell, Burdsall & Ward Bolt and Nut Co.**, Port Chester, N. Y. mfr. of Delrin and nylon fasteners.

Lt. Gen. James M. Gavin (USA Ret.) elected pres. of **Arthur D. Little Inc.**, research organization. He succeeds **Raymond Stevens**, who retired.

Charles F. Siebold joined **Lockhard Tool & Engineering Co.**, plastics div., Lynwood, Calif., as production mgr. in charge of fibrous glass reinforced plastic aircraft, missile and electronic parts and components.

Al Neeme, dist. sales mgr. for **Michigan Chrome & Chemical Co.**, transferred from West Coast to Ohio, Kentucky area, with headquarters in Dayton, Ohio. He will direct tech. sales to company accounts in the appliance, electroplating, and plastic coating industries.

Robert Rodriguez joined **The Fiberite Corp.**, Winona, Minn. mfr. of plastic molding compounds, as a sales engineer in the Los Angeles, Calif. area.

Martin E. Marks appointed v-p and sales mgr. for the **U. S. Peroxygen Sales Corp.**, Richmond, Calif. mfr. of organic peroxide catalysts for the plastics industry.

Samuel B. Lippincott named mgr., Fibers Div., **Chemore Corp.**, general reps. in the U. S. and Canada of **Montecatini Soc. Gen.**, Milan, Italy; will be responsible for the marketing and commercial development, in the U. S., of Montecatini's new polypropylene fiber Meraklon. He was previously mgr. of merchandising and product development of American Viscose Corp.

Frank P. Cyrill Jr. appointed a PVC plastic engineering rep. in the Boston, Mass. and New York, N. Y. sales territories of **A. M. Byers Co.**, suppliers of plastics pipe.

Rolla H. Taylor appointed sales mgr. for **Scott Testers Inc.**, Providence, R. I. mfr. of a broad line of physical testing equipment.

John S. Thies named sales mgr., extrusion laminating div., for **American Sisalkraft Corp.**, Attleboro, Mass. He will direct sales of polyethylene-coated papers, foils, and liner board.

George T. Wingate appointed sr. sales rep. to the chemical div., **The Goodyear Tire & Rubber Co.** in the Philadelphia, Pa. dist. for plastics, synthetic rubbers, latices, and chemicals produced by the div.

Jack Lehmann named industrial sales mgr. of **Velcro Corp.**, New York, N. Y. suppliers of self-adhering nylon fasteners.

Theodore V. Busk, advertising mgr., retired after 45 years of service with **Farrel-Birmingham Co. Inc.**, Ansonia, Conn. The company's advertising program continues under the direction of two div. mgrs., **Arthur Strahan** and **Harry Genzken.**

Milton J. Lax, national sales mgr. of **Kreidel Plastics Inc.**, Cleveland, Ohio, elected to his second term as chrmn. of the Plastics Weatherstrip Mfrs. Div. of **The Society of the Plastics Industry Inc.**

I. E. Becker named tech. service mgr. in charge of the newly-created field research div. of **Extrudo-Film Corp.**, Long Island City, N. Y.

Charles H. Frantz appointed dir. of engineering of **Lenox Plastics Inc.**, St. Louis, Mo., mfrs. of a line of melamine dinnerware.

Ralph M. Plumley appointed product engineer for **Beetle Plastics Corp.**, Fall River, Mass. He will be responsible for design and development of corrosion resistant components fabricated from polyester resins.

Edmond V. Tyne appointed sales mgr. for the Harchem Chemical Dept. of **Wallace & Tiernan Inc.**, mfrs. of plasticizers.

William B. Erb elected pres. of **Polyco Inc.**, Smyrna, Ga., mfr. of plastic missile components and swimming pool equipment, and currently entering **(To page 260)**

COMPANIES... PEOPLE

(From page 259)

into production of plastic bottles. Polyco is an affiliate of **Scientific-Atlanta Inc.**, an electronics mfr.

Walter N. Jackson appointed plant mgr. of **Spaulding Fibre Co. Inc.**, Tonawanda, N.Y., mfr. of vulcanized fiber and Spauldite laminated plastics for industry.

New reps.

Michigan Wholesalers Inc., with headquarters at 154 W. Michigan Ave., Jackson, Mich., and regional offices in Toledo and Athens, Ohio; Fort Wayne, Ind.; and Dunbar, W. Va.; appointed regional distributor by **Du Pont's** Film Dept. for PE film for construction and agricultural uses . . . **King Chemical Corp.**, St. Louis, Mo., appointed by **General Latex & Chemical Corp.**, Cambridge, Mass., as distributor for their new urethane foam prepolymer, which is tradenamed Vultafoam. . . .

Wm. K. Nelson Co., Minneapolis, Minn., appointed sales rep. by **Whitlock Associates Inc.**, Oak Park, Mich. mfr. of pneumatic and vacuum conveyors and dehumidifying dryers . . . **John S. Lee**, Wooster, Ohio, appointed mfr.'s rep. for melamine dinnerware made by **Lenox Plastics Inc.** . . . **S. L. Abbot Co.**, 4255 District Blvd., Los Angeles, Calif., appointed distributor in Southern Calif. for **Plastic Molders Supply Inc.**, Fanwood, N. J., suppliers of dry colorants, pastes, and dispersion materials. **Bud Dyke** is special rep. . . .

Wrap-Ade Machine Co. Inc., Clifton, N. J. mfr. of heat sealing, film packaging machinery, named **Sumner E. Perkins Co.**, 1605 Solano Ave., Berkeley, Calif., and **Charles Industrial Sales**, 5201 First Ave., S., Seattle, Wash., as West Coast reps. . . .

Ram Chemicals Inc., Gardena, Calif., appointed the following distributors for its line of gel coats, mold releases, and pigment dispersions: **C. P. Waggoner Sales Co. Inc.**, 301 S. E. 14th St., Grand Prairie, Texas; **Allied Resin Products**, 216 Milk St., Boston, Mass.; **Philadelphia Resins Co.**, P. O. Bldg., Flourtown, Pa.; **Florida B & B Distributing Co.**, 250 W. 24th St., Hialeah, Fla.; and **Kristal Kraft**, 900 Fourth St., Palmetto, Fla. . . .

Union Carbide Plastics Co. appointed the following distributors: **The Cary Co.**, 228 N. La Salle St., Chicago, Ill. will distribute coating resins in Iowa and parts of Ill., Ind., and Wis.; **Van Horn, Metz & Co.**, 201 E. Elm St., Conshohocken, Pa., will handle coatings materials in the Middle Atlantic states; and **The A. C. Mueller Co.**, 14625 Detroit Ave., Cleveland, will distribute carbide materials in Northeastern Ohio.—**End**

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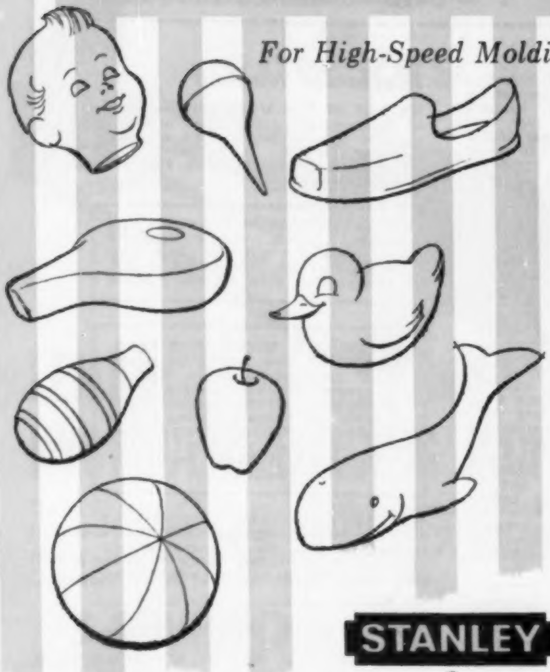
For High-Speed Molding plus ***Consumer Appeal!***



More and more manufacturers are discovering the advantages of Stanley Plastisols in the production molding of resilient or rigid hollow articles. Custom-formulated to precise specifications, vinyl Plastisols from Stanley are favored for producing play balls, drug sundries, toys and many other products . . . ideal, also, for exploring new-product possibilities.

- **CONSUMER APPEAL** . . . Products made of Stanley Plastisols have an attractive appearance that sparks impulse buying. Colors are rich and permanent; the color range is unlimited and gives you a wide choice for *your* product.
- **UNUSUAL ADAPTABILITY** . . . You supply the exact description of the processes to be used and the products to be made. Stanley will furnish the correct compounds. The Stanley Chemical Company has developed vinyl dispersions that give your products compatible characteristics – resiliency, color stability, resistance to heat and/or cold, tensile strength, etc. – no matter what molding technique you use.
- **LOWER COST THROUGH HIGH-SPEED PRODUCTION** . . . Stanley Plastisols are designed to help you reduce per-unit costs by helping you to get the maximum number of pieces per hour. Your production line achieves peak efficiency, with fewer rejects, and shapes that are exact duplicates of the original.

Write today for complete information and engineering assistance.

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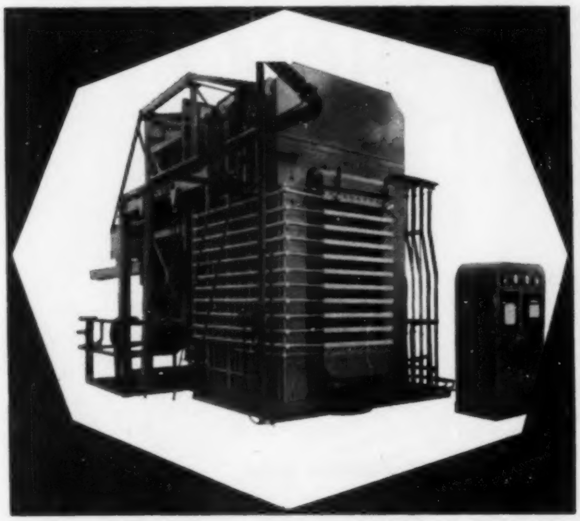

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For automatic lamination, Becker & van Hüllen presses are "perfect jewels"—with *automatic* loading, *automatic* unloading and *automatic* sheet handling. For details on the presses most likely to fit your needs, write Karlton today, giving desired sizes, pressures and operating conditions.

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Machinery and Equipment for sale

MIXER AND MILL FOR SALE: One Baker-Perkins mixer Machine No. 42566, size 4-AN 2 Laboratory dispersion mixer —Working capacity .07 gallons, total capacity 1 gallon, 2 h.p. gearhead motor. Also one Stewart Boiling rubber mill. Machine No. 4182, Size #0, 6 and 6 in. by 12 in., 7½ h.p. gearhead motor. F. P. Fourre, The Rap-in-Wax Company, 150 26th Avenue S.E., Minneapolis 14, Minn.

MOST MODERN PACKAGING and processing machinery. Available at great savings. Baker Perkins, W. & P. and Day Double Arm Steam Jacketed Heavy Duty Mixers—25, 50, 75, 100, 150 and 200 gal. capacities. Devine 650 gal. Jacketed Double Spiral Mixer. Day 2½ gal. MDA Mogul D.A. Vac Experimental Mixer. Fitzpatrick Models D, K-7 and K-8 Stainless Steel Comminuters. Werner & Pfleiderer 3,000 gal. and 3,500 gal. Jacketed Double Arm Mixers. Stokes Models R, RB-2 and DD2 and Eureka Tablet Machines. Colton 2RP, 3RP, 3B, 5½ T Tablet Machines. Mikro Pulverizers, Models 1SH, 2TH, 3TH and 4TH. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers, Jacketed and Unjacketed. Also wood and enamel. Day Imperial 75 gal. Double Arm Mixer, Sigma, Dispersion Blades. Package Machinery, Hayssen, Scandia, Wrap King, Campbell, Miller Wrappers. Pneumatic Scale Automatic Carton Feeder, Bottom Sealer, Wax Liner, Top Sealer with Interconnecting Conveyors. Standard Knapp, A-B-C, Ferguson Carton Sealers. Union Standard Equipment Company, 318 Lafayette Street, New York 12, N.Y. Phone: CAnal 6-5334.

FOR SALE: MPM 3½" wire covering Extruder. New ¾" Plastic Extruder. Other sizes up to 6". 4 New Farrell Birm. 14" x 30" two roll Mills. Watson-Stillman 240 ton, ten 24" x 56" platens. Baldwin-South. 200 ton Semi automatic transfer Molding Press. Baldwin-South. 150 ton downstroke 48" by 40" platens. Stokes Standard 150 ton semi-automatic. French Oil 120 ton self-contained. 120 ton upstroke, 29" x 21" platens, 10" stroke. 60 ton Farquhar 50" x 50" platens, 30" stroke. Stokes 50 ton semi-automatic 22" x 12" platens. 50 ton Birdsboro 24" x 20" platens. 30 ton Birdsboro 21" x 14" platens. Hydraulic pumps and accumulators. New ¾ oz. Bench Model Injection Machines. Van Dorn 1 oz. and 2 oz., other sizes to 100 oz. capacity. Baker Perkins and Day Jacketed mixers. Plastic Grinders. Seco 6" x 12" and 8" x 16" mills and Calenders. Stokes BB2 and RD3 Rotary-Preform Tablet Machines, also single punch ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Company, 107 8th Street, Brooklyn 15, New York.

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machine 1 oz. to 60 ozs. never used and used. Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747.

FOR SALE: 1 MPM 2½" electrically heated plastics extruder; 2 Cumberland 7" stair step dicers, stainless steel; 1 Baldwin 150 ton self-contained compression molding press; 1 Despatch 10 drawer electrically heated oven, 400 degrees F; 1 Readco 25 gallon stainless steel vacuum double arm mixer; 3 Stokes tablet presses, models F, R, RD-3. Chemical & Process Machinery Corp., 52 9th Street, Brooklyn 15, N.Y.

FOR SALE: NRM 3½"—Model 50 Extruder. 15:1 L/D Ratio, complete with control panel and U.S. Vari-drive. Machine now in use. Good condition. Crator Mfg. Co., P.O. Box 248, Tionesta, Penna.

REAL VALUES: 60 oz. HPM Injection Molding Machine, late type, inspect on location. Complete with all controls equipped with exact weigh feed and mold coolers. 600 Ton Adamson Multi-opening Hydraulic Press. 26" diameter chrome-plated ram, slab side construction. Press contains nine 42" x 42" platens. New 1951. Stokes Model "R" and Colton Model 4½ T, single punch Tablet Presses. Individually motor driven. NRM 1½" Electrically Heated Plastic Extruder. Complete with wheelco panel board and Vari-speed drive. 75 ton Baldwin-Southwark Transfer Molding Press, completely self-contained with all operating controls. 300 ton Stokes Transfer Molding Press, model 250-A with dual Vickers Hydraulic Pumping System. 2 oz. Watson-Stillman Vertical Injection Molding Machine. Completely self-contained with all operating and heat controls. 2½ oz. Van Dorn Full Automatic Injection Molding Machine. Also in stock: Van Dorn 1 oz. lever-operated Injection Molding Machine, Van Dorn 2 oz. Semi-automatic Injection Molding Machine, new 1955, NRM 2½", Royle 3¼", Hartig 3¼" and Adamson 6" Extruders. Also a complete line of Blenders, Mixers, Scrap Cutters, etc., for the Plastic and Rubber Industries. What Do You Need? What Do You Want? We Will Finance. Johnson Machinery Company, 683 Frelinghuysen Avenue, Newark 12, New Jersey, BIgelow 8-2500.

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16 OZ. WATSON-STILLMAN Injection Molding Machine, in excellent operating condition. 1953 model. Available for immediate delivery. Reply Box 6516, Modern Plastics.

FOR SALE: 2-Head Boston Plastic Blow-Molding Machine. Rego, Inc., 830 Monroe Street, Hoboken, N.J., OL 6-2020.

WALL TILE MOLDS: 2 sets—9 molds, .050", .060" $6M. R.P. 10D8 '48 $5M. W.S. 16 oz '48 $9M. Special price on lot. Send for list 100 inj. machines thruout USA. Fred C. Ziesenheim M.E., 523 King Ave., Marion, Ohio.

FOR SALE: Stainless reactors or resin Kettles: 3500, 2200, 1900, 1300, 1000, 750, 500, 350 gal. jktd. and agit. Baker-Perkins dbl. arm mixers: 200, 100, 50 gal. capacity, steel or stainless. Perry Equipment Corp., 1429 N. 6th., Phila. 22, Pa.

Machinery Wanted

WANT LESTER L-1-4-4 Injection Molding Machine. Does not have to be in working order but must have good frame. Spir-It, Inc., 115 Center St., Malden, Mass.

WANTED: Positive matched metal dies, approximately 6-10" deep, 10-15" long and 6-10" wide; hardened steel construction, for reinforced plastics evaluation. Reply Box 6514, Modern Plastics.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747.

Materials for sale

FIBERGLAS MAT: Short pieces, short rolls, non standard widths and weights. 50,000 lbs. now available at ½ regular prices and less. Top quality soluble binder and press mat available in addition to a regular supply of cut offs. Reply Box 6518, Modern Plastics.

VIRGIN REGULAR natural polyethylene at lowest prices ever. Will supply uniform material in any quantity. Price dependent on quantity taken. Reply Box 6524, Modern Plastics.

Materials Wanted

WE ARE IN THE MARKET for all types of thermoplastic scrap; also surplus or obsolete lots of reprocessed or virgin molding powders. D. Linder Plastics, Inc., 1825 Raspberry St., Erie, Pa. Phone GLendale 4-8146.

POLYESTER RESIN WANTED: Off standard, gelled, discontinued, off color, etc., any quantity. Also, pigments, peroxides, glass cloth and mat, etc. Reply Box 6519, Modern Plastics.

GET THE TOP MONEY FOR PLASTIC SCRAP: Now paying top prices for all thermoplastic scrap. Wanted: polystyrene, cellulose, acetate, vinyl, polyethyiene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. WRITE, WIRE, TODAY! Reply Box 6522, Modern Plastics.

WANTED: Alan will buy your polyethylene film, lumps, purgings, rejected parts, regrinds, pellets, etc. A complete compounding plant stands ready to serve you. Alan Plastics Corp., Canton, Mass.

PLASTIC SCRAP WANTED: Styrene, Acrylic, Polyethylene, Butyrate, Acetate, Vinyl, Nylon, Etc. We PAY TOP DOLLAR for your plastic scrap and surplus molding powders in any form. We also supply molding powders to the plastic industry at reasonable prices. Please contact for information. Philip Shuman & Sons, 571 Howard Street, Buffalo 6, N.Y. MA. 3111.

Molds wanted

OVERSEAS PLASTIC MOULDER having compression and injection moulding machines of 50/100 tons and 8/10 ounces wants permanent arrangement for getting steel moulds of electrical accessories, household and domestic articles on rental basis. Moulds will be returned in good condition. Those interested apply with photographs and terms of business to Box 6512, Modern Plastics.

OBSOLETE INJECTION MOLD for experimental work. Must be in good operating condition. Shape desired such as shallow box, serving tray, etc. Approximate width 12" to 18", length 14" to 20". Would consider compression type mold which could be converted. Please include part and mold drawings with price and location for inspection. Reply Box 6538, Modern Plastics.

Molds for sale

MOLD FOR SALE for export use only. Beautiful Italian style lace basket. Single cavity die fits any 4 oz. or larger machine. Reply Jaydon, Inc., Box 52, Farmingdale, N.Y.

STEEL DIES for injection molding 4" to 8" dolls with sleeping eyes; complete with all assembly jigs. A-1 condition. Reply Box 6531, Modern Plastics.

FOR SALE: Injection dies to fit Reid-Prentis 8 oz. machine and two sets of molds to mfg. the 12 inch three dimentional plastic crucifix. Dies $1950.00. Stock on hand $1650.00. Business discontinued due to death. Sold only 5200 crosses. H. Rochowiak, 8714 W. Jefferson, Detroit 17, Mich.

(Continued on page 264)

(Continued from page 262)

Help wanted

JUNIOR SALESMAN: Nationally known prestige Midwest plastics sheet and film extruder has immediate opening for an aggressive salesman between 25 and 40. Thermo plastic background preferred. Midwest territory. Opportunity for a man with a college background. Salary, incentive; car and travel expenses furnished. Other company benefits. Submit resume and salary requirements in strict confidence. Reply Box 6513, Modern Plastics.

SUPERVISOR: Product and Process Engineering. Position open for Mechanical Engineer with main experience in nylon injection molding and some experience in compression molding. To handle process development within the Plant and some travel and customer relations with regard to new product development. Responsible for supervision of design tooling and quality control. Age 30 to 45 years. Salary $12,000 to $15,000. Reply Box 6515, Modern Plastics.

TECHNICAL SALES REPRESENTATIVE: For growing plastics industry division of leading special-purpose chemical manufacturer. Vinyl-processing experience desirable. Chemical background mandatory for technical support of vinyl-stabilizer and epoxy plasticizer sales program. Salary-incentive. Location headquarters. Send resume to Vice President—Marketing. Nuodex Products Company, Elizabeth, New Jersey.

POLYESTER RESIN CHEMIST with B.S., M.S. or Ph.D. degree needed for expanding research department of progressive company. Experience in the field of unsaturated polyester resins is desired. Original work will be encouraged. Liberal benefits. Please send complete resume including present salary to: Dr. Jay E. Meili, Director of Polymer Development, Freeman Chemical Corporation, 211 East Main Street, Port Washington, Wisconsin.

SALES MANAGER: For Blow Molded Products in new rapidly expanding division covering consumer, packaging and industrial products. Must have imagination, initiative, plastics experience and proven sales ability. PRODUCTION MANAGER: Rapidly expanding Blow Molding division. Must have engineering degree and at least 3 years plastics experience. Blow molding experience desirable but not mandatory. Location—Southern Connecticut. Write for interview enclosing resume and present salary to: T. F. Anderson, HAVEG INDUSTRIES, Plastics Park, 900 Greenbank Road, Wilmington 8, Delaware.

NEED EXPERIENCED MAN with know how of plastic reprocessing operation. Prefer person willing to make investment. Forward complete resume of background and experience. Replies will be held in strictest confidence. International Rubber & Plastics Company, 1017-19 Chouteau Avenue, St. Louis 2, Missouri.

TECHNICAL LABORATORY: An excellent opportunity for a young man to join the expanding Plastics Division of Spencer Chemical Company. This man should have a degree in engineering or a related field with experience in the field of thermoplastics. He will perform studies on extrusion and molding of polyolefins and nylon and will have some field technical service responsibilities. In reply, please send detailed resume to: Personnel Manager, Spencer Chemical Company, 610 Dwight Building, Kansas City 5, Missouri.

PLASTICS ENGINEER: Attractive opening in engineering research on new polymers. Position carries responsibility and leadership for developing polymer fabrication and polymer application techniques. Applicant should be a graduate Engineer or equivalent with experience in injection molding and extrusion. Suburban Phila. research laboratories offer excellent facilities. Liberal benefits. Please send details of education, experience and personal information to: PENNSALT CHEMICALS CORP., P.O. Box 4388, Phila. 18, Pa.

MOLDING DEPARTMENT MANAGER: For new department with large multi-plant manufacturer. We are seeking a man with five to ten years of progressively responsible experience in the field of compression and transfer molding on automatic and semi-automatic equipment. Career opportunity requiring extensive managerial experience in captive molding operations. Will have full responsibility for mold engineering, investigation of new materials, quality, cost and personnel. Progressive Philadelphia manufacturer. Please submit resume to: P-4, P.O. Box 2069, Philadelphia 3, Pa.

SALES REPS WANTED: New and expanding corporation requires sales representatives for its G-10 product—a copper-clad epoxy glass base material—used for etching, printed, flush and plated circuits. Many territories open. Inquire immediately to: Precision Laminates, 7 East Franklin St., Danbury, Connecticut.

INJECTION MOLDING SUPERINTENDENT: A substantial New England heel manufacturer requires molding superintendent with 10-15 years supervisory experience molding heavy sections in Acetate, Implex, Cycolac and Styrene. Must be able to assist Engineering Department in mold design as well as responsibilities of Molding Department. Full benefits, Blue Cross-Blue Shield, Life Insurance, Vacation and Pension Program. Send full resume with salary expected to Box 6528, Modern Plastics.

FLORIDA LOCATION: Plant manager wanted with plenty mechanical know-how in sheet extrusion and vacuum forming. If you have ability, dynamic leadership, and want to earn a good living and have fun doing it, contact us in confidence. We are a publicly owned small company, stock has doubled in nine months. Ownership possibilities through performance. Reply Box 6530, Modern Plastics.

PLANT MANAGER: Unusual opportunity for man thoroughly versed in polystyrene injection molding and plant management. Take complete charge of growing molding plant for Chicago manufacturer. Responsibilities include maintaining production schedules and output, supervising maintenance of molds and machines, directing activities of department personnel. Become part of progressive management team that takes pride in national reputation for top quality products, sound policies, well trained personnel, modern plant facilities. Enjoy security, opportunity for advancement, profit sharing and other benefits in company with growing volume and expanding operators. Write in confidence complete personal data, job history, salary requirement. Reply Box 6533, Modern Plastics.

MOLD DESIGNERS — SUPERVISOR: Growing Chicago company needs men experienced in design of injection molds, also needs a lead man for supervising this department. A thorough knowledge of injection molds a must. Permanent positions for men with initiative. Send complete resume and salary expected to Box 6532, Modern Plastics.

CHEMIST: Experienced in formulating vinyl organosols, especially for paper or fabric coating. Full particulars on education, experience and salary requirements. Reply Box 6540, Modern Plastics.

SERVICE MAN: Excellent opportunity for young man with thorough knowledge and experience of injection molding, electrical wiring, hydraulics and heavy machine assembly, to demonstrate, test, and service injection molding machines. Position involves traveling. Excellent company benefits. Replies confidential—should include qualifications and salary requirements to: Personnel Department, Lester Engineering Company, 2711 Church Ave., Cleveland 13, Ohio.

SALES REPRESENTATIVE WANTED: to sell recognized Pearl Essence Pigments. Should know plastic and coating industries. Choice territories still open. Reply Box 6541, Modern Plastics.

Situations wanted

PLASTICS EXTRUSION ENGINEER, graduate degree. Ten years working experience development and production of polyethylene film and numerous extrusions in all plastics. Full knowledge of die and machine design, and continuous production. Added know-how in plastics compounding, packaging, and sales. Seeking responsible position. State salary range offered. Reply Box 6509, Modern Plastics.

EXECUTIVE SALES: Age 49. Twenty years experience in Packaging as executive and sales manager in Plastics, Rubber and Glass fields, seeking position as sales manager or representative, on salary or commission basis after territory is established. Want to locate in south Gulf Coast area if possible. Experienced in foreign sales. Reply Box 6520, Modern Plastics.

PLASTICS ENGINEER: M.E. Grad, 35. Specialist in compression and transfer molding, well-versed injection, too. Nine years mold and product design, production and sales-liaison experience with custom-molders; one year technical-service experience with material supplier. Seeks challenging position with progressive company where talents may be fully utilized. Reply Box 6525, Modern Plastics.

SALES ENGINEER, or Technical Service, 12 years experience marketing and technical activities in thermosetting and thermoplastics. B.S. Degree. Reply Box 6529, Modern Plastics.

CHEMICAL ENGINEER: 31. Recent experience in fabrication of reinforced plastics and plastic building materials. Broad chemical process development background includes polyolefins and polyethers. Desires projects in fabrication or process development. Reply Box 6521, Modern Plastics.

CHEMICAL ENGINEER with broad background in polymerization. Experience—process and project engineering; economic evaluation; start-up. Licensed P.E. Age 37. New Jersey, New York, Connecticut and Boston areas preferred. Box 6523, Modern Plastics.

CHEMIST, ORGANIC: Ph.D. 3 years development experience flexible polyurethane foams, free rise and molded. 8 years research and customer service. Age 35. Reply Box 6526. Modern Plastics.

PLASTIC ENGINEER 17 years experience in industry looking for position with a large firm or on an agency basis to handle products in Colo., Utah, Wyo., Mont. Very familiar with this country. Resume will be sent upon request. Reply Box 6527, Modern Plastics.

PLASTICS PROCESSING EXECUTIVE: 20 Years experience in research, sales, new product development, cost control, purchasing and customer service. Compound manufacture, compression and injection molding, extrusion and laminating. Healthy, cooperative, honest, college honor student with excellent references. $18,000. Reply Box 6533, Modern Plastics.

COMMERCIAL DEVELOPMENT: Market product fibers and resins background; industrial applications, non-wovens; experience in vinyl coatings, high-pressure laminates, reinforced plastics. B.S., Engineering. M.B.A., Marketing Management. Desires challenging creative position expanding present and potential markets. Young, aggressive. Reply Box 6535, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE: Seeking molding and extrusion lines. Covering all six New England States, calling on O.E.M. and industrial distributors. Technical knowledge of all thermosets and thermoplastics. Years of experience selling industrial plastics. Excellent sales record, complete knowledge of market. List materials processed, methods and if custom or standard products. Reply Box 6537, Modern Plastics.

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PLANT MANAGER: Age 39. Capable of assuming full responsibility for operation of your injection molding plant. Have managed 15-machine plant and coordinated sales program. Strong tooling & engineering background with 20 years actual experience. Completely familiar with molding and decorating on all thermoplastics. Willing to relocate. Resume available. Reply Box 6539, Modern Plastics.

Miscellaneous

FOR SALE . . . PREMIUM or GIFT ITEM To liquidate estate must sacrifice molds, masks, stock and copyright of plastic sweeper. Corporation with carry-back tax loss available. B. B. Rosen, 1959 E. 71 St., Chicago 49, Ill.

EUROPEAN MARKET—WESTERN GERMANY: Leading well established German offset printer (Rhein-Ruhr district), 500 employees, well financed, seeks connection with U.S. company to obtain license or representation for negative gauge pressure or suction pressure for plastics moldings, gravure or similar proven products or production methods which are well established in the states. Managing Director plans U.S. trip in June 1960 to establish contact or conclude agreements. Urgent reply to Box 6510, Modern Plastics.

SUCCESSFUL SALES ORGANIZATION Available for Exporters to Benelux. Here's a rare opportunity for someone seeking a distribution set-up in the Benelux area! For 12 years, with great success, our firm has represented one of the largest U.S. producers of plastic materials. Only because they are setting up their own organization, we will lose one of our major products. We are seeking new plastic and chemical lines. Excellent references. Offices in Brussels and Rotterdam. Write: IMEXIN S.A., 5, Av. de Broqueville, 15, Brussels, Belgium.

WELL-ESTABLISHED West German Injection-Molder wishes to quote on high-volume nylon products up to three (3) ounces. Excellent mold making facilities on premises and well located in the heart of the plastic mold manufacturing industry. Modern plant insures prompt delivery. Representative for engineering residing in New York City. Reply Box 6511, Modern Plastics.

WANT A BUSINESS of your own? Have you line supervisory experience in: Reinforced plastics, ducts, tanks, boats? Job estimating? Willing to work?—If yes, would you be interested in: a full partnership? To help formulate new company policy? Locate in the Southwest or Gulf Coast? Reply Box 6534, Modern Plastics.

CUSTOM DRAPE VACUUM Forming: Interested in forming large size, long run items. Maximum forming area 40" x 60". Maximum Drape 18". Maximum Draw 24". Val Case Corporation, Westwood, New Jersey.

WELL-KNOWN BRITISH FIRM forming part of large engineering group and producing substantial quantities of phenolic laminates, flexible insulation, plastics and rubber treated textiles, is seeking lines for expansion where specialized knowhow, patents or capital can restrict competition. The company has adequate technical and financial resources to manufacture and sell in Britain, Europe and the Commonwealth countries. A meeting with any patentee or manufacturer with lines capable of development in these territories would be welcome. Repy Box 8517, Modern Plastics.

ITALIAN MANUFACTURER of PVC sheeting plain, embossed, printed, various thicknesses, wide range of designs and qualities, also material with cotton back, already exporting in many parts of the world, seeks a well introduced agent for the U.S. market. Send full particulars to Box 6536, Modern Plastics.

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MARKET DEVELOPMENT PLASTICS

Excellent opportunity in PennSalt Chemicals Corporation's new and expanding market development program in plastics. We are seeking a man with the following qualifications:

- Graduate Chemist or Engineer
- 3 to 8 years' experience in the fabrication and application of thermoplastics, preferably in the area of injection molding and extrusion.
- Flair for market development and technical service work.

This position is, in our Research Products Development Department, located at our Whitemarsh Research Laboratory in Suburban Philadelphia.

Please send resume of personal data, education, experience and salary requirement to:

PENNSALT CHEMICALS CORP.
RESEARCH PRODUCTS DEVELOPMENT DEPT.
P.O. Box 4388, PHILA. 18, PA.

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MODERN PLASTICS

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EDITORIAL

About standards for RP boats

According to the best information we can get, there are today more than 250 makers of reinforced plastics boats in the country. This number is bound to change often as some makers fold up or get out of the business, while others come in. Nevertheless, it is a safe bet that not 10% of these outfits know how to properly design and build a reinforced plastics quality boat.

Somebody is going to get hurt—maybe many people.

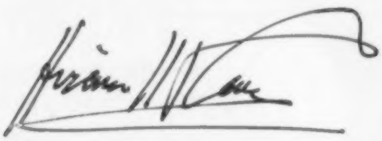
And when a RP boat turns over or swamps in high water because of bad design and manufacture, when a motor tears out a too-thin transom, when the drownings are published, who will be blamed? The plastics industries and their materials and products in general!

Here is one of the fastest-growing applications of plastics (see the lead article in MODERN PLASTICS for Feb. 1960, p. 83) and partly because it is fast-growing, we have the makings of, if not a great disaster, a major problem which could only lead to loss of prestige, public appreciation, and business.

An exact prototype of every RP boat made should be tested for seaworthiness, proper design for stress, proper functional trim and its fastening, proper reaction to punishment. On production units of those that pass the tests, labeling should tell the story.

Who is to do the job? The Office of Consumer Counsel, State of California, is studying it. That's only one state. The American Power Boat Association has shown interest. There are only a handful of boat makers who are members of S.P.I., so, in spite of the fact that S.P.I. is the great sponsor of voluntary standards in plastics, that association cannot move unless requested. Its standards machinery could, however, help a lot.

If something is not done, and soon, we can expect enforced testing and approvals from state regulatory bodies—and possibly even from the Coast Guard.



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